The Genus Daemonorops in Malaya

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DAEMONOROPS is a genus of rotans so closely allied to Calamus that it was often regarded as a section of the latter. This is because Calamus is comparatively a polymorphic genus with sections having characters very near those of Daemonorops. However the one character by which a Daemonorops species may be readily distinguished from that of Calamus lies in the function of the spadices, which in Daemonorops never serve as climbing organs. Consequently the spadices are generally short, never show a tendency to become long and whip-like or to produce a whip-like appendage (flagellum) at the apex, nor bear on spathes or axes or both, reflexed hooks which are the kind of spines which aid a plant to climb. The spathes moreover all fall off excepting the outermost one which in some cases persists for a long time; even in these cases the persistent basal spathe splits throughout its entire length on the ventral side.

In Calamus, on the other hand, even when the spadices are short and bear no whip-like appendage, the spathes and the axis of the spadix are armed with hooked claws; the spathes are persistent and tubular at least at base. This last character is specially useful in distinguishing from Daemonorops the small species of Calamus which, being acaulescent, may not show even the vestigial hooks and appendices in spadices. In very rare cases, as in C. *hypoleucus* of India, this tubular base may not be conspicuous because of the shortness of the basal tube and drying out of the spathe; in such instances the fact that the seed albumen is homogeneous also that the secondary spathes are tubular, will clinch the species as of Calamus.

2. Daemonorops and Calamus

The entire set of characters that would distinguish a Daemonorops from a Calamus, is well brought out by

Beccari (Ann. Roy. Bot. Gard. Calc. XII, 1911 p. 16). The following is adapted from Beccari's notes:—

ORGAN	*DAEMONOROPS*	*CALAMUS*
Leaf-sheaths	Never flagelliferous; a few provided with annular crests.	Flagelliferous or not; never with annular crests.
Ocrea ..	Always very short; only in *D. ursinus*, it is prolonged into two long appendages.	Often greatly developed, at other times short.
Leaves ..	The upper ones always more or less cirriferous.	Cirriferous in some whole groups, in others not.
Leaflets ..	Generally narrow and acuminate; never rhomboidal or premorse.	Variable; in a few species rhomboidal, and in one case premorse.
Spathes ..	After flowering open, short cymbiform or flat, deciduous, excepting the outermost in some cases persistent; never armed with claws.	Always tubular and tight-sheathing, at least in basal half; armed with more or less claws in their lower portions at least in the climbing species. In *C. hypoleucus* almost open as in Daemonorops, but yet there is a small basal tube.
Spadices ..	Form a panicle, mostly a very short one; no claws on the axial parts.	For the most part greatly elongated and flagelliferous; or if panicled is set with claws on the axial parts (in climbing species).
Spikelets, ♂	Very rarely comb-like, most having flowers imperfectly bifarous, with scale-like or bracteiform, not tubular spathels.	Almost always perfectly bifarous, with infundibular spathels.
Spikelets, ♀	Provided almost always with very short annular spathels. (In *D. longispathus* and *D. ruptilis* funnel-shaped spathels).	Provided with infundibular spathels.
Involucrophore ..	Pedicelliform, truncate, and almost without a limb.	Either infundibular or cupular.
Involucre ..	Usually truncate, more rarely cupular.	Cupular.

Flowers ..	Calyx truncate or superficially 3-dentate; corolla about twice as long as the calyx.	Calyx deeply trilobed or tripartite. Male corolla considerably longer than the calyx; female corolla about as long as the calyx, rarely longer and in one case shorter (in *C. adspersus*) than the calyx.
Seed ..	More or less always deeply ruminate; chalazal fovea indistinct, pit-like, or reduced to a narrow slit, very rarely in the form of a canal penetrating the seed.	In a few cases more or less deeply ruminate; mostly homogeneous with superficial intrusions the chalazal fovea distinct and deeply channelled into the albumen.
Embryo ..	Always basal.	Most often basal, but sometimes lateral.

3. The Flowers

In my previous paper (Gard. Bull. Straits Settl. IX, 1937 p. 156) I supported Beccari's views that different kinds of spadices are not found on the same stem. On each stem and even on the different stems of the same clump, the spadices produced are all of one kind—all are either male or all are fruit-producing. In the latter spadices however each female is generally acolyted by one male flower which is much smaller than those in a male spadix of the same species. This acolyte flower often does not reach its full development but falls off as the female flower begins to mature. Most of these acolyte flowers appear to be sterile or neutral, but some develop pollen. In *D. Kunstleri* no acolyte flower seems to grow by the side of female flowers, or if found, they fall off leaving no, or an inconspicuous, mark or areola. Further, fruits and seeds develop in *D. Kunstleri* even when the male plant does not occur in the vicinity to provide pollen for fertilization of the female flowers. In view of this it seems probable that most of the fruits of the Daemonorops species develop parthenogenetically (without the aid of the pollen from the male flowers), only a few fruits being perhaps developed through the fertilisation by pollen from the acolyte flowers or from the flowers of the male plant in the vicinity.

Ants are commonly found visiting the flowers of Daemonorops species, and in this genus more than in Calamus the armature on some of the leaf-sheaths and spathes is specifically favourable for the nesting of the ants. These ants may be responsible for bringing pollen from younger spadices to the respective female flowers of older spadices. Winds may bring pollen from the neighbouring male plants.

4. Geographical Distribution

In its geographical distribution the genus Daemonorops is much more restricted than Calamus. Though the centres of the maximum development of both these genera are the same, namely, a region comprising Sumatra, Malaya and Borneo, Daemonorops, unlike Calamus, does not occur at all in Africa, Himalaya, peninsular India, Ceylon, Australia, New Guinea and the Fiji Islands. In each of the countries which form so to say the outermost boundaries of the area of its distribution,—Assam, Burma, Siam, Cochinchina, South-China and the Aru Islands—the genus Daemonorops is represented by only one species. Two species are known from the Andamans, three from Java, five in Celebes, two in the Moluccas, and seven in the Philippines. In all there are about eighty-five known species of Daemonorops, that is slightly less than one-third of the total number of the species of Calamus. The areas so far not well investigated are Sumatra, Borneo and the Lesser Sunda Islands, and so a few more species may be added to this total number.

5. The Malayan Species

The genus is represented in Malaya by thirty-two species. Of these sixteen species belong to the section *Cymbospatha,* and the other sixteen to the section *Piptospatha.* The four new species described in this paper are *D. Kiahii, D. laciniatus, D. Nurii* and *D. stipitatus.* Hitherto *D. macrophyllus* was known only from a sterile type specimen collected more than sixty years ago in Perak; here descriptions of the spadix and the fruit are given based on the collection made by Corner in Kemaman. The following species have been reduced here for the first time;—*D. hygrophyllus* to *D. angustifolius, D. microthamnus* and *D. petiolaris* to *D. calicarpus, D. vagans* to *D. Kunstleri, D. Curtisii* to *D. Lewisianus, D. annulatus* and *D. pseudomirabilis* to *D. sabut,* and *D. aciculatus* to *D. sepal.*

Newer collections lead one to suspect that Beccari's interpretation of *D. intermedius* was based on a mixture as explained in my observations made under this species and under *D. laciniatus.* After comparing the new and the old material, I have adopted a new interpretation for *D. intermedius.* What I considered formerly to be this species has been identified with *D. monticolus.* A part of *D. intermedius* sensu Beccari appears to be *D. laciniatus* and the other *D. grandis.* However *D. intermedius, D. laciniatus* and *D. monticolus* require further study.

6. Key to the Sections

(A) Spadices short, before flowering more or less fusiform and beaked, and completely enclosed by the outermost spathe; after flowering short-branched, densely paniculate. The outermost spathe concave, cymbiform when open, distinctly beaked, generally bicarinate on the outerside Section CYMBOSPATHA.

(B) Spadices elongated; before flowering cylindraceous (not fusiform nor beaked), only lower part being enclosed by the outermost spathe; after flowering diffusely branched. The outermost spathe not contracted into an elongated beak, after anthesis elongate-lanceolate or flat Section PIPTOSPATHA.

KEY TO THE SPECIES

A. Cymbospatha

1a. Spadices crowded to the summit of the plant (Leaflets 51–20 mm. in width or less). Stems short, erect or semi-erect (2).

1b. Spadices not crowded at the summit of the stem. (Leaflets 15–20 mm. or much more broad). Stems long, scandent (5).

2a. Stems short, erect, about 1–1·50 m. tall. Lamina of the leaves axillant to the spadices considerably reduced or absent. Outermost spathes thickly covered with subcriniform spines *D. calicarpus.*

2b. Stems longer, subscandent. Leaf lamina not so reduced in the upper parts of the stem. Outermost spathe armed remotely with laminar spines (3).

3a. Fruit scales yellow, straw-coloured, with a dark coloured spot at the apex and lighter margins *D. Lewisianus.*

3b. Fruit scales tawny coloured with very dark margins (4).

4a. Leaf-sheaths armed with long spines at the mouth and at the base of the petiole. Tobacco-coloured fluff present in young stages of sheaths and spathes, deciduous later *D. monticolus.*

4b. Leaf-sheaths not so armed. Tobacco-coloured fluff thickly persistent even on well developed leaves and the spathes *D. tabacinus*

5a. Leaflets broadly ensiform, usually 3 cm. or more in width. (Fruit scales straw yellowish) *D. grandis.*

5b. Leaflets 15–20 mm. rarely 25 mm. in width. (Fruit scales straw or tawny coloured) (6).

6a. Leaflets closely set, 1·5–3 cm. apart. (Fruit scales tawny or straw coloured; spadices sessile or stalked) (7).

6b. Leaflets remotely set, 3 cm. or more apart. (Fruit scales straw coloured; spadices sessile) (14).

7a. Fruits obovate or obovate-elliptic or oblong. Fruiting spadix often conspicuously stalked and bent downwards (8).

7b. Fruit globose or ovate elliptic, nearly as long as broad. Fruiting spadix not or obscurely stalked (12).

8a. Fruit scales straw coloured with whitish margins, with a fine dark yellow intramarginal line and a darkish apex *D. Nurii.*

8b. Fruit scales tawny brown, with conspicuous dark marginal lines (9).

9a. Fruits obovate or turbinate, 20–25 mm. long (10).

9b. Fruits oblong or elliptic, 25–30 mm. long (11).

10a. Fruit scales as long as broad *D. Sepal.*

10b. Fruit scales broader than vertically long *D. Scortechinii.*

11a. Fruit scales as long as broad or longer (vertically) *D. imbellis.*

11b. Fruit scales broader than long *D. Kiahii.*

12a. Fruit scales straw coloured *D. pseudo-sepal* (partly).

12b. Fruit scales tawny brown (13).

13a. External spathes covered densely with narrow, sometimes subcriniform spines; often the second spathe also densely armed. The base of the leaf-sheath at the point of the spadix insertion usually densely armed with porrect spines *D. melanochaetes.*

13b. External spathe remotely armed usually with broad, triangular spines. Spadix base and the leaf-sheaths at its insertion not densely armed *D. angustifolius.*

14a. Unopened spadix apparently short beaked. Spadix axis very slender *D. pseudosepal* (partly).

14b. Unopened spadix long beaked. Spadix axis stout (15).

15a. Unopened spadix very narrow, hardly ventricose; external spathe sparingly armed with solitary spines; second spathe unarmed or almost so *D. angustispathus.*

15b. Unopened spadix thicker, ventricose; external spathe more thickly armed (16).

16a. Spines on the external spathe slender often joined together in a short series. The second spathe somewhat densely armed towards the upper half. Involucrophore shortly pedicelliform *D. intermedius.*

16b. Spines on the external spathe often broad and laciniate; second spathe sparingly armed along the two carinae. Involucrophore long, pedicelliform *D. laciniatus.*

B. Piptospatha

1a. Leaf-sheaths armed with isolated or confluent spines, not with ring-like laminar crests (2).

1b. Leaf-sheaths armed with spines united at their bases to form laminar crests, either complete or incomplete, or both, horizontal or oblique (11).

2a. Fruit not resiniferous (6).

2b. Fruit resiniferous (resin red) (3).

3a. Leaf-sheaths armed with feeble, deciduous, acicular spines seated on wrinkles or warts *D. micracanthus.*

3b. Leaf-sheaths armed at least partly with strong permanent flat and elongate spines, not wrinkled or warted (4).

4a. Leaflets lanceolate, geminate or grouped in some parts of the leaf-rachis, and inequidistant in others. (Fruit scales arranged in 12–15 vertical series) *D. didymophyllus.*

4b. Leaflets equidistant or almost so, ensiform. (Fruit scales in 16–21 vertical series) (5).

5a. Stem long, scandent. Leaflets 30–40 cm. long, 2·5–3 cm. broad. Fruit scales in 16–18 vertical series *D. propinquus.*

5b. Stems acaulescent or short. Leaflets 40–60 cm. long, 4·5–6 cm. broad. Fruit scales in 18–21 vertical series *D. brachystachys.*

6a. Spadices in flower not loosely paniculate, male always cupressiform, strict. Spathes coriaceous or woody; the outermost almost cymbiform, provided with two obscure keels (8).

6b. Spadices in flower diffuse, loosely paniculate. Spathes elongate-lanceolate, thickly coriaceous, conspicuously bicarinate (7).

7a. Leaflets in distinct groups of 2–3 in each. Stem long, scandent. Leaf-sheaths conspicuously gibbous. Peduncle often 30–40 cm., or shorter, armed with flabby spines *D. periacanthus.*

7b. Leaflets not in conspicuous groups, inequidistant or geminate. Stem short, erect or semi-scandent. Leaf-sheaths not gibbous or obscurely gibbous. Peduncle 40–80 cm. long, unarmed *D. longipes.*

8a. Leaf-sheaths coriaceous armed with long, flat, erect spines at the mouth. Outer spathe coriaceous, not woody (9).

8b. Leaf-sheaths hard, woody, armed with short spines at the mouth. Outermost spathe usually woody *D. leptopus.*

9a. Stem acaulescent, or short, erect or semi-scandent. Leaf-sheaths slightly gibbous or not. Fruit spherical or nearly so (10).

9b. Stem long, scandent. Leaf-sheaths conspicuously gibbous. (Leaflets bristly on 3–5 nerves beneath). Fruit long or elliptic (with its scales in 12–15 vertical series) *D. hystrix.*

10a. Leaf-sheaths slightly gibbous or not, armed up to the petiole base with unequal, criniform and laminal spines, often united at base to form an interrupted irregular series or row. Leaflets bristly on 3 nerves beneath. Fruit 14–17 mm. in diam,, with scales arranged in 15–18 vertical series *D. Kunstleri.*

10b. Leaf-sheaths not gibbous, unarmed immediately below the petiole base, but lower down armed with laminar, solitary or subseriate spines. Leaflets setose on 5 nerves beneath. Fruit 20–25 mm. in diam., with its scales in 13–15 vertical series *D. lasiopathus.*

11a. Leaf-sheaths furnished with simple oblique, membranous, spinulose crests. (Leaflets distinctly grouped) *D. geniculatus* (partly).

11b. Leaf-sheaths with horizontal, more or less laminate crests (12).

12a. Leaflets very broad, 50–60 cm. long, 8–12 cm. wide *D. macrophyllus.*

12b. Leaflets much narrower (13).

13a. Leaflets few, inequidistant or arranged in distinct groups (14).

13b. Leaflets numerous, equidistant (15).

14a. Leaflets 10–13 in all, not spreading in all directions, arranged in distinct groups, 10–16 cm. long, 15–20 mm. broad digitate claws found even on the petiole *D. oligophyllus.*

14b. Leaflets 10–20 on each side, arranged in groups or geminate or inequidistant in parts, in the basal group usually spreading in all directions, 25–40 cm., 1·5–3 cm. broad; digitate claws not found on the petiole *D. sabut.*

15a. Crests on leaf-sheaths horizontal, upturned and reflexed, two opposing crests forming sometimes completely closed galleries; the spines of the crests mostly slender, criniform. Petioles up to 2 cm. broad or less, flat or slightly convex, with spines not pointing towards the median (16).

15b. Crests on the leaf-sheaths never pointed upwards and no galleries formed; spines of the crests mostly broad, laminar, petiole 2·5–3 cm. broad, broadly channelled armed with spines towards the median *D. geniculatus* (partly).

16a. Involucrophore short, almost enclosed in the spathel. The flat, triangular spines on the leaf-sheaths and at its mouth light coloured or spadiceous *D. verticillaris.*

16b. Involucrophore long, pedicelliform. Flat spines on the leaf-sheath and at its mouth black or schistaceous *D. stipitatus.*

8. Enumeration of the Species

A. SPECIES OF THE SECTION CYMBOSPATHA

Daemonorops angustifolius (Griff.) Mart., Hist. Nat. Palm. III (1850) 329; Becc. in Hook. f., F. Brit. Ind. VI (1893) 464, et in Ann. Roy. Bot. Gard. Calc. XII (1911) 69 t. 18; Ridl., Mat. Fl. Malay Pen. II (1907) 174, et Fl. Pen. V. (1925) p.p.; Furtado in Gard. Bull. Straits Settl. IX (1937) 159.

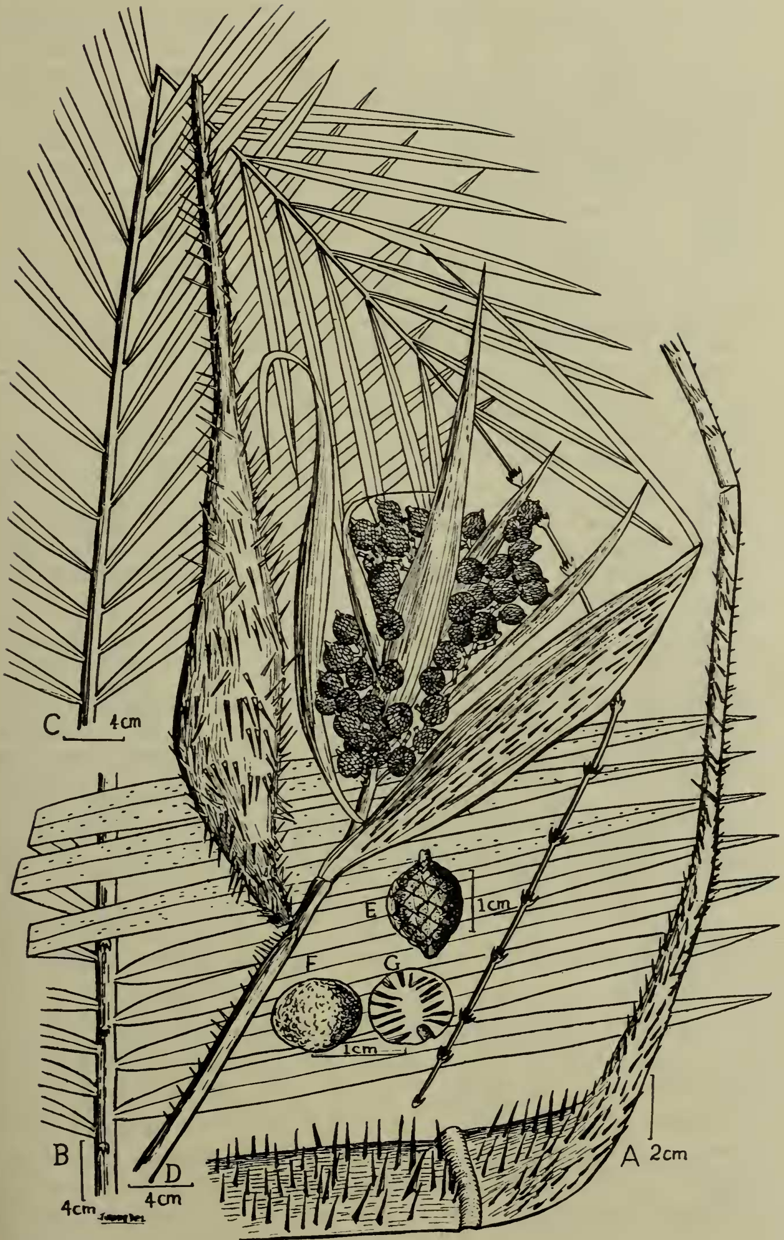
D. carcharodon Ridl., Mat. cit. II (1907) 178 et in Flora cit. V. (1925) 40.

D. hygrophilus Griff. in Mart. Hist. cit. III (1850) 204 et 328 t. 177 f., II; Becc. in Hook. f. Fl. cit. VI (1893) 464; Ridl., Mat. cit. II (1907) 178; Becc. in Ann. cit. XII (1911) 62 t. 13; Ridl., Fl. cit. V (1925) 40; Furtado in Gard. Bull. cit. IX (1937) 167.

Calamus angustifolius Griff. in Calc. Journ. Nat. Hist. (1844) 89 et Palm Brit. Ind. (1850) tt. 213 A and B.

C. hygrophilus Griff., Palms cit. (1850) 96 t. 213–C.

Stem tufted, scandent, about 10–15 m. long, with sheaths 2–3·5 cm. in diam., often covered with deciduous, tobacco-coloured fluff in sheaths and spathes. *Leaf-sheaths* gibbous above, armed with many, flat solitary scattered or subseriate, triangular, unequal, ascendent spines up 2 cm. long, shorter spines in the gibbous part and often a few longer at the mouth. *Leaves* long, cirriferous; petiole about 8–12 cm. long, flattish above, convex below, more or less densely armed on both surfaces, specially in older plants, with unequal up to 1 cm. long, rigid, spreading, ascendent or slightly reflexed spines; rachis in its lower portion prickly on both surfaces like the petiole, but less armed in the distal portions; the dorsal spines 3–5-nate in the terminal parts.



Daemonorops angustifolius (Nur 34,127).

A, Fragmentum petioli cum vaginae parte. B.C.: Fragmenta frondis cum foliolis. D, Spadix fructiferus. E, Fructus. F, Semen. G, Semen verticaliter discissum.

Leaflets numerous, equidistant, 10–15 mm. apart, about 20–35 cm. long, 10–15 mm. broad, more or less bristly in the three nerves above and on the mid-costa below. *Spadices* male and female externally similar, erect sessile or nearly so, fusiform before anthesis, gradually narrowed into a long beak; outer spathe cymbiform, bicarinate, armed with flat, triangular 1–3·5 cm. long, scattered or united in short interrupted series of 2–4 porrect when young, later somewhat reflexed, not callused at the base spines; the second spathe often bicarinate, armed with a few to many solitary, scattered spines or in some cases unarmed altogether; other spathes unarmed. *Female spadix* without spathes up to 25 cm. long, with 5–7 branches often subdivided again into secondary porrect branches; secondary spathes similar, reduced to a ring extended on one side into broadly, triangular acute limb. *Involucrophore* about 2 mm. long in flowers, up to 5 mm. in fruits, expanded into an obliquely cupular apex; involucre cupular, truncate, entire, with a tumescent, distinct areola of the acolyte flower. *Female flowers* ovate, 5 mm. long; calyx urceolate, obsoletely 3-denticulate, strongly striate; corolla almost twice as long as the calyx with narrow segments. *Fruiting perianth* explanate. *Fruit* globose, slightly longer than broad, 13–14 mm. in diam., 14–16 mm. in length, excluding the conical beak; scales in 15–18 series, shining, slightly channelled, reddish brown colour with darker margins when young, becoming with age yellowish or straw-coloured on the intramarginal line with whitish scariose margin and dark tip. *Seed* suborbicular, rather flattened on two sides, 10–12 mm. in diam., 8–9 mm. thick, deeply ruminate; embryo basal.

MALAYA: *Perak*, Temango (Ridley 14,719 male and female). *Pahang*, Sungai Bera near Tasek Bera (Henderson 24,620). *Selangor*, Telok? (Burkill 6,520); Batu Tiga (Ridley 11,983 partly; other part = D. grandis); Pataling (Ridley 7,880); Sungei Tinggi at Kuala Selangor (Nur 34,127 as *Rotan Getah*). *Negri Sembilan*, Seremban (Furtado 33,134). *Johore*, Danau by Sungai Sedili (Corner in III–1932 as *Rotan Tawar*); Sungai Semangat in Muar (Fox 11,299). *Singapore*, Choa Chu Kang (Ridley in 1896); Bukit Panjang (Ridley 13,302); Selitar (Ridley 6,279); Chan Chu Kang (Ridley 4,622 as *Rotan Sepat*); Bukit Timah (Ridley in 1900); Bukit Mandai (Ridley on 21–X–1900).

CULTIVATED: *Singapore*, Botanic Gardens (Ridley 5,123 partly; other part = D. grandis); Lawn W. (Anderson in April 1913; Furtado 30,662, male and female; Ridley 10,807; Burkill on 15–V–1916).

JAVA: Botanic Gardens, Bogor (Furtado 30,901).

In my previous paper *D. hygrophilus* and *D. angustifolius* were maintained as two distinct species, but after a comparison of new material I have reduced the former to a synonym of the latter. The armature on the spathes and leaf-sheaths vary a good deal in this species, depending perhaps on the age of the clump, and on the environments in which it grows. In Griffith's plates *D. angustifolius* is more armed in leaf-sheaths and spathes, though the spines are shorter, than *D. hygrophilus*, but Beccari identified the latter with specimens having shorter but less spines—an identification followed in my previous paper.

Daemonorops angustispathus Furtado in Gard. Bull. Straits Settl. IX (1937) 161.

Stem and leaf-sheath not known. *Leaf* apparently large; petiole not known; leaf-rachis in the portion seen armed with thin, short, very remote spines. *Leaflets* many, subequidistant, 4–5 cm. apart, linear-lanceolate or ensiform, broadest below the middle, 45 cm. long, 15–18 mm. broad, strongly narrowed into an acuminate apex; in the upper surface the three nerves armed, or sometimes the midnerve armed only towards the apex or entirely unarmed; in the lower surface the midnerve alone closely setulose. *Inflorescence* only one seen, female, sessile, very narrowly fusiform when enclosed in the outermost spathe, 45 cm. long with a beak as long as or slightly longer than the body; spathes deciduous; the outermost spathe bicarinate, the space between the carinae about 1 cm. broad, deciduously furfuraceous, armed with a few, solitary or sometimes united, laminar or subcriniform, black up to 2·5 cm. long spines, the second and the third spathes broader, armed more or less with a few solitary spines; others unarmed; primary branches, 4, porrect, up to 6 cm. long; spikelets 2·5 cm. long with 2–4 flowers on each side and with a conspicuously flexuous axis. *Involucrophore* thick, slightly longer than the spathel; involucre generally deeply cup-shaped, rarely shallow; areola conspicuous. *Fruiting perianth* explanate, corolla nearly twice as long as the calyx. Fruit only immature seen ovate elliptic, about 18 mm. long, 10–12 mm. in diam; scales whitish in the margins, straw-coloured in the centre and a broad brownish intra-marginal line.

MALAYA: *Province Wellesley,* Bukit Juru (Ridley 7,002, Holotype).

Judged from the colour changes in the different fruits, it looks as if the scales would all be straw-coloured in dry matured fruits and will have a whitish margin and a thin brownish intra-marginal line.

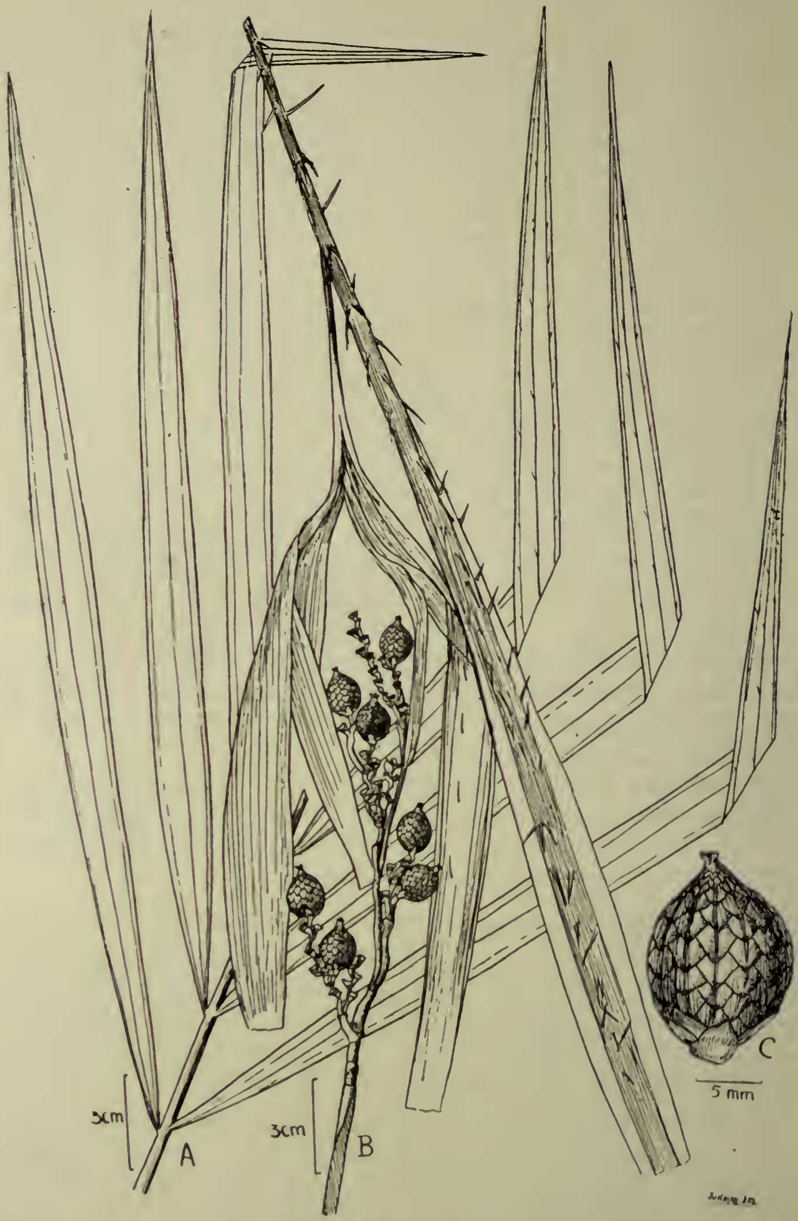
Owing to a printer's error in the original description, the spathes were described as being persistent when they are all non-persistent (deciduous). It is possible that this is only a poor specimen of *D. angustifolius.*

Daemonorops calicarpus (Griff.) Mart., Hist. Nat. Palm. III (1850) 326 t. 175 f. VI.; Becc. in Hook f., Fl. Brit. Ind. VI (1893) 446; Ridl., Mat. Fl. Mal. Pen. II (1907) 174 p.p.; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 94 t. 43; Ridl., Fl. Mal. Pen. V (1925) 37 p.p.; Furtado in Gard. Bull. Straits Settl. IX (1937) 462.

D. Lewisianus sensu Furtado op. cit. p. 171 pp.

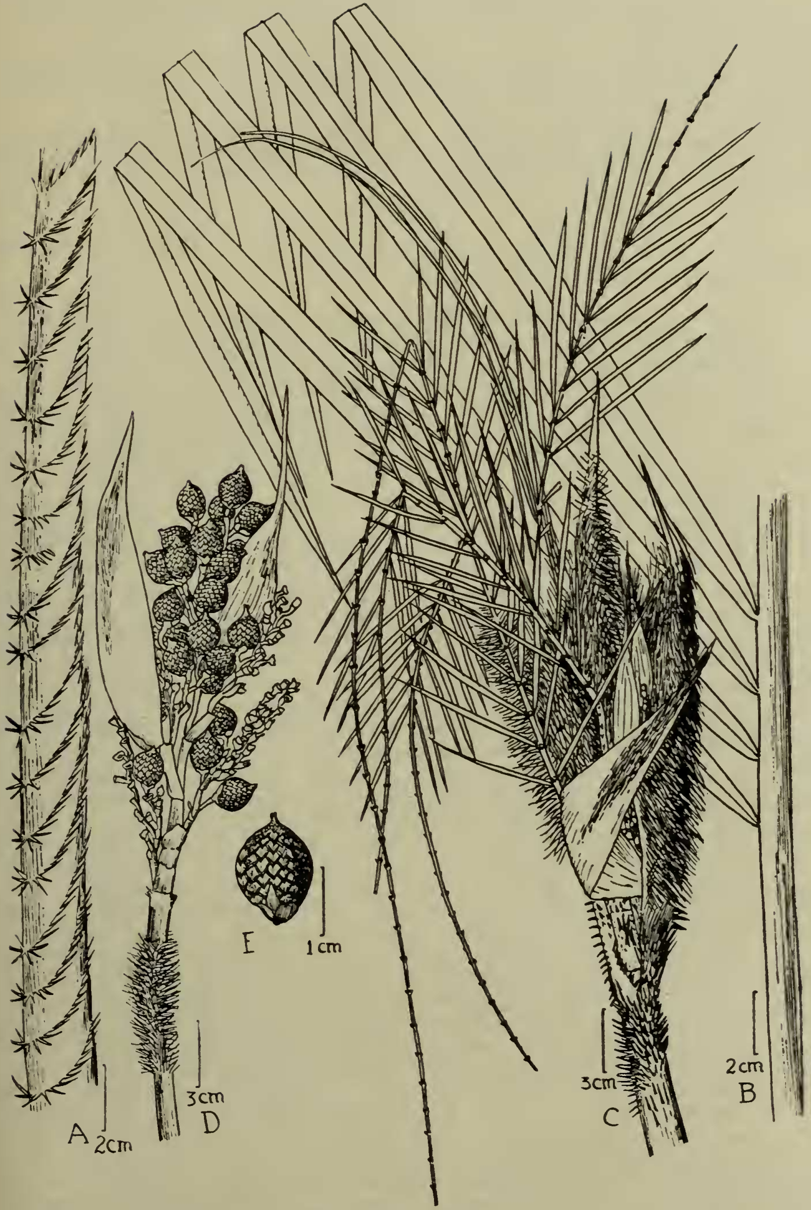
D. microthamnus Becc. in Rec. Bot. Surv. Ind. II (1902) 221; Ridl., Mat. cit. II (1907) 175; Becc. in Ann. cit. IX (1911) 92 t. 32; Ridl., Fl. cit. V (1925) 27.

D. petiolaris Mart. op. cit. III (1850) 326 A-Z XVIII f. 3; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 466 et in Ann. cit. XII (1911) 90 t. 31.



Daemonorops angustispathus (Ridley 7,002).

A, Fragmentum frondis. B, Spadix fructiferus cum spathis primariis. C, Fructus.



Daemonorops calicarpus (Furtado 33,131).

A, Fragmentum petioli ex fronde juvenile. B, Fragmentum frondis juvenilis. C, Fragmentum caudicis fertilis apicale, ut spadices et frondes apicales appareant. D, Spadix fructiferus. E, Fructus.

D. petiolaris var. *nudipes* Becc. in Rec. Bot. Surv. Ind. II (19-2) 221.

D. sepal var. *pahangensis* Furtado in Gard. Bull. Straits Settl. X (1937) 179 p.p.

Calamus calicarpus Griff. in Calc. Journal. Nat. Hist. V (1844) 92 et Palms Brit. Ind. (1850) 99 tt. 215A-D et 216A f. VI.

C. petiolaris Griff. in Calc. Journ. cit. V (61844) 93 et Palms cit. (1850) 101 t. 216 f. VII.

Stem tufted, erect or subscandent, slender, 2–4 m. long with sheaths up to 2 cm. in diam. *Leaf-sheaths* deciduously rusty furfuraceous; those of the radical leaves open on the ventral side, densely armed with almost complete, oblique circles of up to 3–4 cm. long, narrow, laminar ascendent spines, the ventral opening of the petiole being lined with ocrea often armed like the sheath; the sheaths of upper leaves very short, more or less gibbous. *Leaves:* the radical ones about 2 m. long including a long petiole, not cirriferous, gradually becoming smaller towards the apex of the stem; upper leaves 20–80 cm. long petiole, or much reduced at apex, shortly cirrate. *Leaflets* rather numerous, linear, equidistant, closely set, 5–25 cm. long, 3–12 mm. wide, (larger in the radical leaves) bristly along the midrib beneath, and also along the margins, bristles apparently deciduous, and often absent except in the terminal parts of the leaflets of the reduced leaves. *Spadices* very close to each other especially towards the end of the stems, fusiform before flowering, shortly beaked, erect, 10–30 cm. long or less, occasionally longer shortly peduncled; outer spathes covered with deciduous dark brown scurf, armed with more or less densely, solitary or confluent, criniform to narrowly flat, triangular, 2–4 cm. long spines, varying in colour from the pale straw-brown to blackish. *Female spadix* short, 10–20 cm. long, shorter in the apical parts of the stem, divided into 2–4 branches, spikelets very short with 2–3 flowers on each side, sometimes only one; secondary and tertiary spathes bracteiform, amplectent, acuminate; spathels triangular. *Involucrophore* slightly longer than or as long as the spathel, cupular, obconical, at apex one-sided, acute; involucre cupular, truncate, often extended slightly on one side, longer than the involucrophore; areola conspicuous, tumescent. *Female flowers* 5 mm. long; calyx striate; corolla about one and half times as long as the calyx. *Fruiting perianth* almost explanate. *Fruit* spherical to oblong when quite mature, ovoid or elliptic when young, 16–20 mm. long, 15–18 mm. in diam.; scales shining or somewhat dull-brown to yellowish light brown in colour, channelled in the middle, with a narrow darker intramarginal line and lighter, not very distinct, erose margins, arranged in 15–18 series. *Seed* ovate-globose, somewhat compressed on two sides, 10–12 mm. long, 9–10 mm. in diam.; albumen white, deeply ruminate; embryo basilar. *Male spadix* a dense panicle, deciduously rusty furfuraceous in every part; divided into 5–6 primary branches; each branch being sub-divided in 5–7 alternate tertiary branches; each tertiary branch bearing many small spikelets of 3–5 flowers on each side; involucre cupular, striate, 2-denticulate; male flowers with calyx 2–3 times as long as the involucre and half as long as the corolla.

MALAYA: *Perak,* Pangkor (Ridley 7,897); Pulau Rumbia (Seimund in 1925). Bujong Malacca (Curtis 3,160, male and female); Tapah (Ridley, 14,115); Lumut in Dindings (Curtis 3,444 male and female, partly as *Pokoh Chucho;* Ridley 7,899); Gunong Keledang (Curtis 3,351, male and female). *Pahang,* Bentong by Sungai Kesar (Furtado 33,118 as Rotan Chuchok); Fraser Hill (Nur 11,208). *Selangor,* Kuala Lumpur (Ridley in 1911); Dusun Tua (Ridley, 7,878). *Malacca,* Chenana Puteh (Alvins 979, as *Chucho Miniak*); Bukit Sedenan (Derry 112, as *Rotan Sabut*). *Negri Sembilan,* Seremban (Furtado 33,131). *Singapore,* Botanic Gardens, cultivated (Furtado 30,661).

There is a great deal of variation in this species and further studies are needed to clarify whether these variations are due to the age of the plant, soil or climate conditions, or hereditary factors. Collectors have often mixed the specimens of male and female plants on the belief that these plants were specifically the same, though exhibiting some differences in the armature of spathes, etc. This mixture has added to the difficulty of a critical study. The leaf-specimens from both the plants would have revealed better the variation in vegetative characters. Nur 11,208 which formed the basis of *D. sepal* var. *pahangensis* is a mixture and the petiole and leaflets mounted with the spathe and spadix do not apparently belong to the Cymbospathae, and may represent some species of Calamus. I have reduced *D. petiolaris* to this species, because some forms of *D. calicarpus* approach very near this. In colouration of fruit scales and in the form of fruits, it appears possible to distinguish more than one variety in this species, but owing to variations in age and also owing to imperfect specimens and many mixtures, I found it advisable not to separate the varieties.

The form *D. petiolaris* certainly resembles very much *D. Lewisianus,* a species also very imperfectly known. However *D. petiolaris* has tawny coloured scales or fruits, whereas the scales in *D. Lewisianus* are straw-coloured. Better specimens are needed to draw easy distinction between the *D. petiolaris* form of *D. calicarpus* and *D. Lewisianus* on vegetative characters so that even male specimens might be easily distinguished.

Daemonorops grandis (Griff.) Mart., Hist. Nat. Palm. III (1850) 327 t. 175 f. 9 et t. Z-XII f. 11; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 463; Ridl., Mat. Fl. Pen. II (1907) 177 p.p.; Becc. in Ann. Roy. Bot. Gar. Calc. XII (1911) 58 t. 11; Ridl., Fl. Mal. Pen. V (1925) 38 p.p.; Furtado in Gard. Bull. Straits Settl. IX (1937) 164.

D. intermedius var *nudinervis* Becc. in Rec. Bot. Ind. II (1902) nomen et in Ann. cit. XII (1911) 75 t. 21 et 22.

D. Kirtong Griff., Palms Brit. Ind. (1850) 102 t. 216B.

D. malaccensis Mart. in Hist. cit. (1850) 327; Becc. in Ann. cit. XII (1911) 61 p. parte typica. (ex altera parte = *D. melanochaetes*).

C. acanthopis Griff., Palms cit. (1850) t. 2116B.

C. grandis Griff. in Calc. Journ. Nat. Hist. V (1844) 84 et Palms cit. (1850) 91 tt. 210A, B and C. et. 216 (A) f. III.

Stem tufted, scandent, with sheaths 2–4 cm. in diam. *Leaf-sheaths* strongly gibbous above, covered with deciduous, dark scurf, armed with more or less dense, unequal, subseriate or not, non-confluent, laminar, brown or blackish, 2–3 cm. long, (the larger ones), horizontal or deflexed spines, with shorter ones lined at the mouth and spread in the midst of the larger ones on the sheath. *Leaves* very large about 3 cm. long excluding the long cirrus; petiole up to 60 cm. long, subterete armed along the margins on both surfaces with short rigid, unequal spines, and along the centre of the dorsum with short solitary or two or three closely set spines; rachis and cirrus armed with stout digitate claws. *Leaflets* numerous, equidistant, alternate or subopposite, ensiform, 40–50 cm. long, 2–3·3 cm. broad, pale or almost glaucescent beneath, gradually narrowed and suddenly plicate at base, gradually acuminate or acute in non-bristly or slightly bristly tip, smooth on both surfaces, or in the upper surface the midnerve only or sometimes one lateral nerve on each side also slightly bristly in the terminal third, and in the lower surface the midrib alone setulose in the terminal half; margins appressedly setulose. *Female spadix* fusiform before flowering, 30–50 cm. long, erect; without spathes 15–20 cm. long; outer spathe bicarinate beaked (beak often as long as the body), more or less densely laminar, blackish, solitary or confluent, reflexed, (often erect between the ridge and the margin), 2·5–3·5 cm. long, (rarely up to 5 cm.), spines; second spathe armed near its apex and along the two carinae with a few similar spines at apex and along the ridge; other spathes unarmed; flowering axis stout, rigid, densely cupressiform, with 4–5 primary branches; these sub-divided again into 5–7 cm. long (longest) spikelets with 5–6 distichous flowers on each side. *Involucrophore* pedicelliform, sometimes 8 mm. long in the lowermost spikelets, much reduced in the upper ones and nearly as long as the spathel, obconic, gradually expanded into an oblique, or at one side acute, bracteiform limb; involucre shallowly cupular, truncate, entire; areola distinct, almost circular with tumescent border. *Female flowers* ovate, 6 mm. long; calyx striate, slightly more than half of corolla. *Fruiting perianth* explanate, calyx split almost to the base in 3 parts. *Fruit* spherical, very shortly umbonate 18–20 mm. in diam.; scales in 15 longitudinal series, yellowish brown or straw-coloured with margins dark in young fruits but pale or white with dark spotted apex when old; seed globular, deeply ruminate; embryo basilar. *Male spadix* externally like the female, but more divided and more covered with deciduous scurf; spikelets numerous, closely packed, with zigzag axis; flowers 6–8, with a corolla twice as long as the calyx.

MALAYA: *Pahang,* Bukit Chemaga (Henderson 19,484 as *Rotan Relang* and *Chongkak* (Sakai); Tasek Bera (Henderson 24,063). *Negri Sembilan,* Tampin (Burkill 1,372 and 2,551); Senaling (Holttum 9,778); Bukit Sulu (Alvins 1,878 as *Rotan Sunang*). *Malacca,* Chenana Puteh (Alvins 890 as *Rotan Sunang*); Bukit Sedenan (Derry's Collector 110, as *Rotan Chichih Landak*). *Selangor,* Batu Tiga (Ridley 11,983). *Singapore,* Seletar (Ridley 3,506; 3,499 and 3,498; Goodenough X); Bidadari (Ridley 8,957); Ang Mo Kio (Ridley 6,672); Bukit Mandai (Ridley in 1890); Bukit Arang (Ridley 1,660); Changi (Mat. in 1894); Bukit Timah (Ridley in 1890, 1898 and 1900; Goodenough in 1892 as *Rotan Chinchin*); Garden Jungle (Ridley 5,112; 5,123 and 5,124; Ahmad 593).

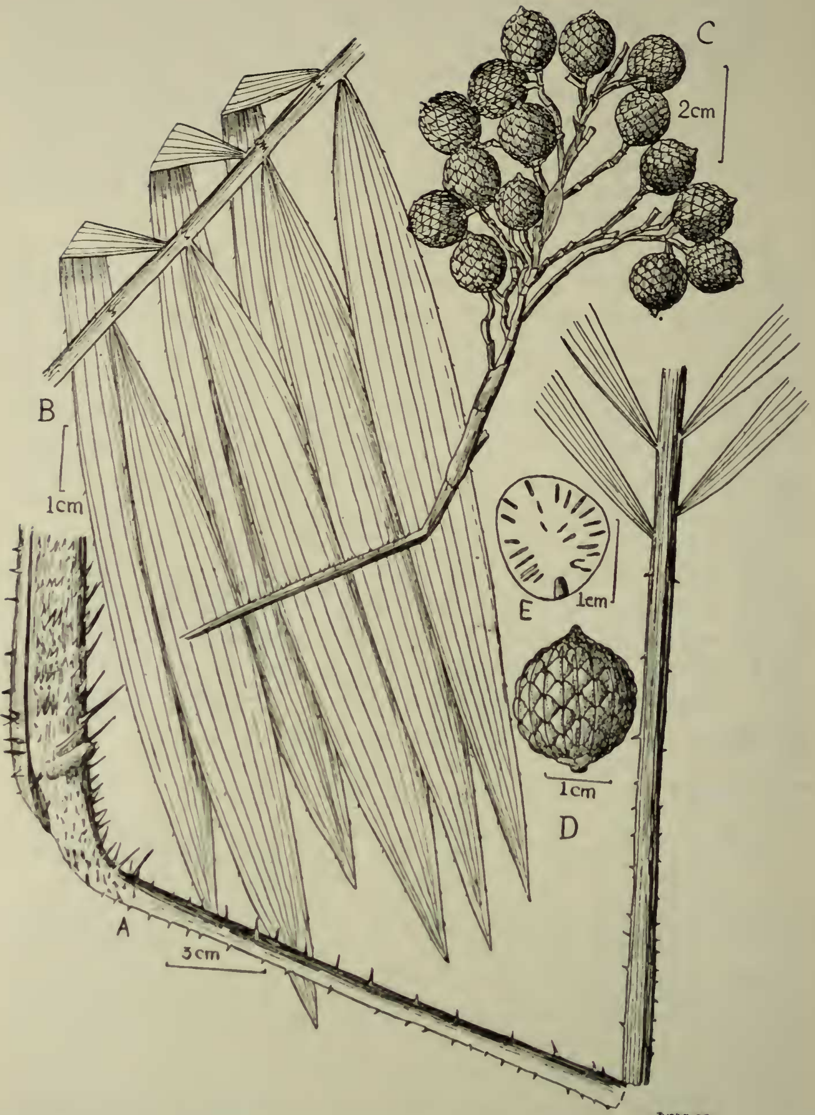
There is a good deal of variation in the armature of the sheaths and leaflets, due to the position of the leaves and the age of the stem. Some leaflets are quite smooth on both surfaces, others have only small setae on the midrib in the lower surface and still others the midrib and sometimes one nerve on each side of the midrib are also setose in the upper surface. It appears that the leaflets on the leaves situated towards the base are more setose than those on the leaves higher up. Beccari states that leaflets are quite smooth in the upper surface, and smooth or slightly bristly in the midrib only in the lower surface, but according to Griffith's original description the leaflets are sometimes setigerous in the midvein on both sides. Ridley 3506 and 3499 have been quoted by Beccari as the syntypes of *D. intermedius* var. *nudinervis,* but in the duplicate of these numbers in Singapore the leaflets are bristly in both surfaces.

D. grandis var. **megacarpus** Furtado **v. nov.**

A forma typica fructibus majoribus, squamis ejusdem magis convexis perianthiis basi leviter collosis, subpedicellatis differt.

MALAYA: *Selangor,* Ginting Simpah (Nur 34,286).

This variety is known only from the incomplete specimens of the holotype collection. As no spathes are represented in it, the comparison has not been easy. In fact better specimens might show it to be a distinct species. Its leaf-sheaths are more armed than in the typical *D. grandis;* fruits are globose, mucronate, about 25 mm. long, 22 mm. in diam; fruit scales arranged in fifteen vertical series, of light straw colour having whitish margins and a thin, almost dark submarginal line, strongly convex towards the base and deeply channelled in the middle; the seed ovate or ovoid, 15–16 mm. long, 14 mm. broad, deeply ruminate, with a basal embryo.



Daemonorops grandis var. *megacarpus (Nur 34,286).*

A, Fragmentum frondis ut petiolus, pars vaginalis et foliola apparent. B, Fragmentum frondis medianum. C, Spadix fructiferus. D, Fructus. E, Semen verticaliter discissum.

Daemonorops imbellis Becc. in Rec. Bot. Surv. Ind. II (1902) 220; Ridl., Mat. Fl. Mal. Pen. II (1907) 179; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 80 t. 26; Ridl., Fl. Mal. Pen. V (1925) 41 inter species dubias.

D. sepal Becc. *sensu* Furtado in Gard. Bull. Straits Settl. IX (1937) 179 quoad syn. *D. imbellis.*

Stem not known, presumably scandent, *Leaf-sheaths* not known. *Leaves* known only from a portion of radical leaf; adult leaves unknown. *Female spadix* stalked, nodding when in fruit, 20 cm. long spathes unknown; main axis slender, bearing 3 branches in the only specimen known, each about 8 cm. long with a few loose spikelets; spathels bracteiform, amplectent, one-sided. *Involucrophore* short and thick, sub-conical, expanded at its apex into an asymmetrical sub-cupular and unilaterally acute limb, callous at its axilla; involucre cupular, truncate, entire, almost immersed in the involucrophore; areola depressed, very conspicuously swollen. *Fruiting* perianth subpedicelliform. *Fruit* large, ovoid-elliptical, 3 cm. long, by 2 cm. across; scales not very shining, in 15 longitudinal series, uniformly tawnybrown, with a sharp dark marginal line, deeply channelled along the centre, with a triangular, non-produced tip. *Seed* globular slightly oblong or a little longer than broad (18 mm. high, 15 mm. thick) slightly gibbous on one side, not very deeply ruminate, embryo basal, slightly to one side.

MALAYA: *Perak* loc. incert. (Scortechini).

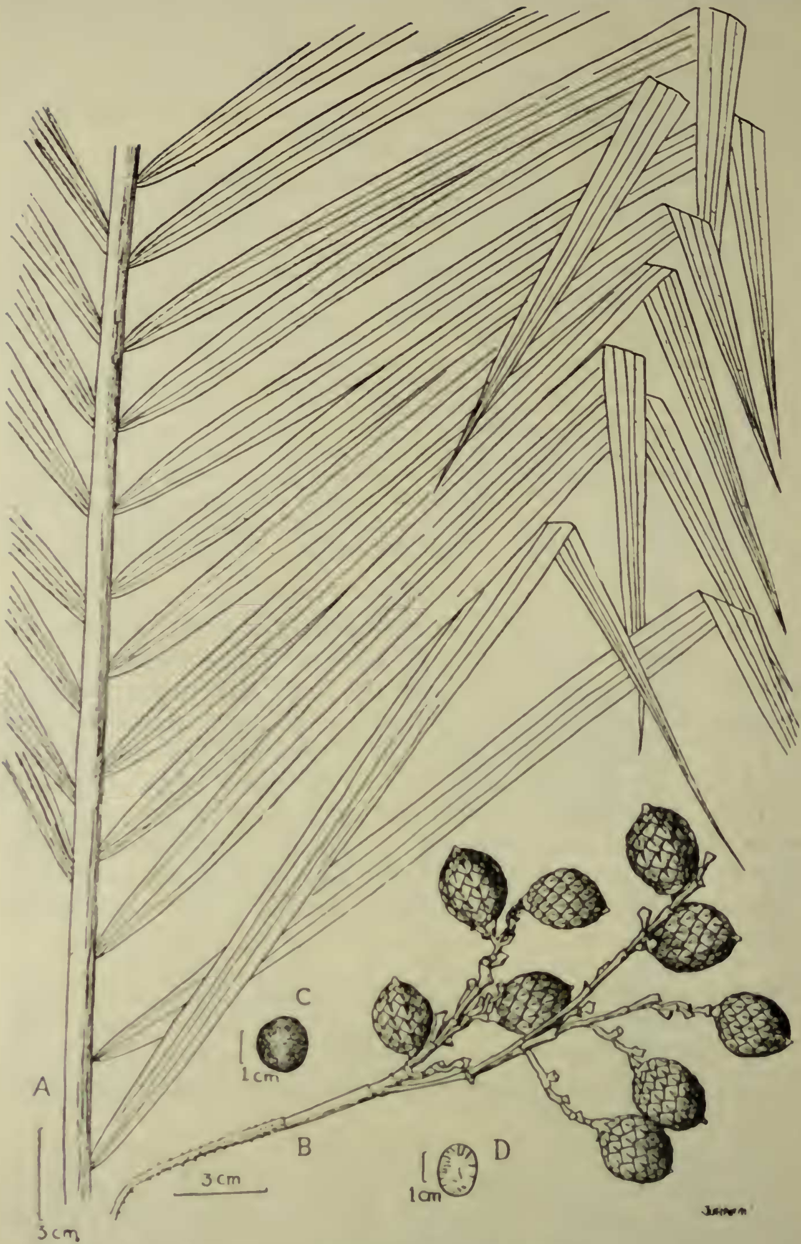
I have not been able to distinguish between this and *D. sepal,* except on the size and shape of the fruits, i.e. as depicted by Beccari, for I have not been able to see the type specimens. Kunstler (King's Coll.) 4133 cited under *D. sepal* had the fruit scales arranged in fifteen vertical series, and the fruits which are young show a tendency to be oblong or elliptic. Perhaps the specimens doubtfully cited under *D. sepal* may be this species. Better specimens are needed to be able to distinguish between these two species. At present it looks as if *D. imbellis* is only a form of *D. sepal* having larger fruits.

Daemonorops intermedius (Griff.) Mart., Hist. Nat. Palm. III (1850) 327 t. 175 f. 8; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 464 et in Ann. Roy. Bot. Gard. Calc. XII (1911) 173 p.p.; Furtado in Gard. Bull. Straits Settl. IX (1937) 168 p.p.

Calamus intermedius Griff. in Calc. Journ. Nat. Hist. V (1844) 86 et Palms Brit. Ind. (1850) 93 t. 211 A and B.

D. grandis Mart. *sensu* Ridl. Mat. Fl. Mal. Pen. II (1907) 177 et Fl. Mal. Pen. V (1925) 38. p.p.

Stem tufted, scandent, 4–7 m. long, with sheaths 2·5–3 cm. in diam. *Leaf-sheaths* gibbous, armed with unequal spines, the largest about 2·5 cm. long triangular, schistaceous, obliquely seated,



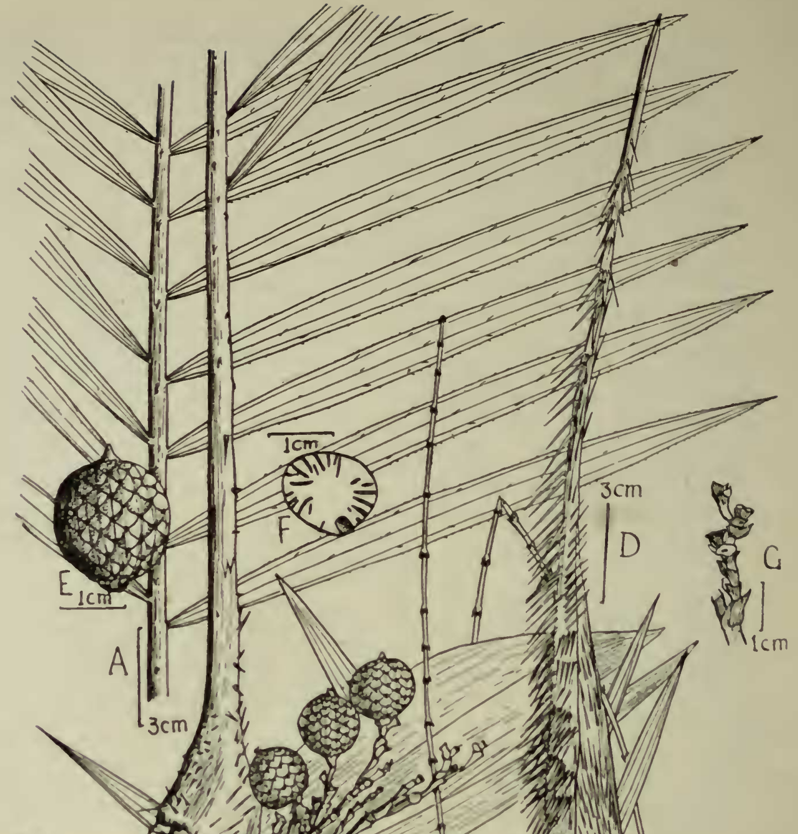
Daemonorops imbellis (ex tab. Beccarii delineata).

A, Frondis pars. B, Spadix fructiferus. C, Semen. D, Semen verticaliter discissum.

solitary or arranged in interrupted, oblique series, the smallest 1 mm. or more long, almost rigid criniform. *Leaves* 1–2 m. long, excluding about 60 cm. long cirrus; petiole about 30–40 cm. long, longer on basal leaves, armed along the margins on both surfaces with short spines, as also in the gibbose base and slightly above it, and with short solitary claws on the median of the dorsum, in the upper surface flat or slightly channelled towards the base, unarmed; rachis armed with 1–3-nate claws on the dorsum. *Leaflets* numerous, equidistant, 3–5 cm. apart, 25–40 cm. long, 20–25 mm. wide, ensiform, gradually narrowed to an acute tip; the three nerves more or less bristly above in the terminal half or two-thirds, in the lower surface smooth or the mid costa alone closely and deciduously spinulous. *Female spadix* erect, sessile or almost so, fusiform, strongly ventricose, 25–40 cm. long, including a long beak; external spathe bicarinate, cymbiform, covered with tobacco-coloured, deciduous scurf, armed with numerous, very narrow, laminar or subcriniform, solitary or united at base in short series; the second spathe armed rather densely; the third and sometimes even fourth armed, though sparingly; spadix without the spathes about 10–20 cm. long, 3–5-branched; spikelets 2–5 flowered. *Involucrophore* slightly longer than the spathel, obliquely cupular; involucre shallowly cupular, truncate, often one side smaller than the other, slightly longer than the involucrophoral cup; areola distinct, tumescent. *Fruiting perianth* almost explanate. *Fruit* spherical, 16–18 mm. in diam. (with umbonate beak and abruptly acute base 20–21 mm. long), oblong or oblong-elliptic when immature; scales arranged mostly in 15, less often in 16, and occasionally also in 17, vertical series, straw-coloured polished, deeply channelled, with whitish margins and a faint, dark yellow intramarginal line and a darkish dot at apex. *Seed* 15 mm. long, nearly as high as broad, 12–13 mm. thick, flattened on one side, ventricose on the other, deeply ruminate with a white core; embryo slightly on one side, above the base, below the apex of the ventricose side, deeply ruminate, with a white non-ruminate portion near the embryo.

MALAYA: *Perak*, Kroh (Furtado 33,040-neotype).

Perhaps here belongs Furtado 33,022 and 33,038 collected also in Kroh Perak. Alterations in the field numbers of Furtado 33,020 (also from Kroh) make me suspect that this collection has been mixed: a part with unaltered numbers show that it is identical with *D. laciniatus* while spadices with altered numbers resemble those of Furtado 33,022 and 33,038 which appear more near to *D. intermedius* than to *D. laciniatus*. These two species are separated with difficulty, and specimens of more adult stages are needed to clarify their status. Most of the specimens collected under these two species were from young plants in a secondary jungle easily accessible to the village people. From *D. laciniatus, D. intermedius* is distinguished by more ventricose spadices, more densely armed external and second spathes, shorter involucrophores, shallower involucres, almost explanate perianth, fruiting scales more shining and disposed



Daemonorops intermedius (Furtado 33,040).

A–B, Fragmenta frondis. C, Pars caudicis, cum petiole et spadice. D, Spadix ante anthesin. E, Fructus. F, Semen verticaliter discissum. G, Ramus spadicis ut involucrophora involucraque appareant.

in 15–17 vertical series and the embryo remote from the base.

Griffith noted that this species cannot be easily separated from *D. grandis* except by its narrower leaflets and more dense armature on the spathes. Martius noted that fruit scales were yellowish and arranged in 15–16, occasionally 17, series (in *D. laciniatus* they are usually in 18 series, rarely 17).

Perhaps the fruiting spadix described under *D. tabacinus* belongs here.

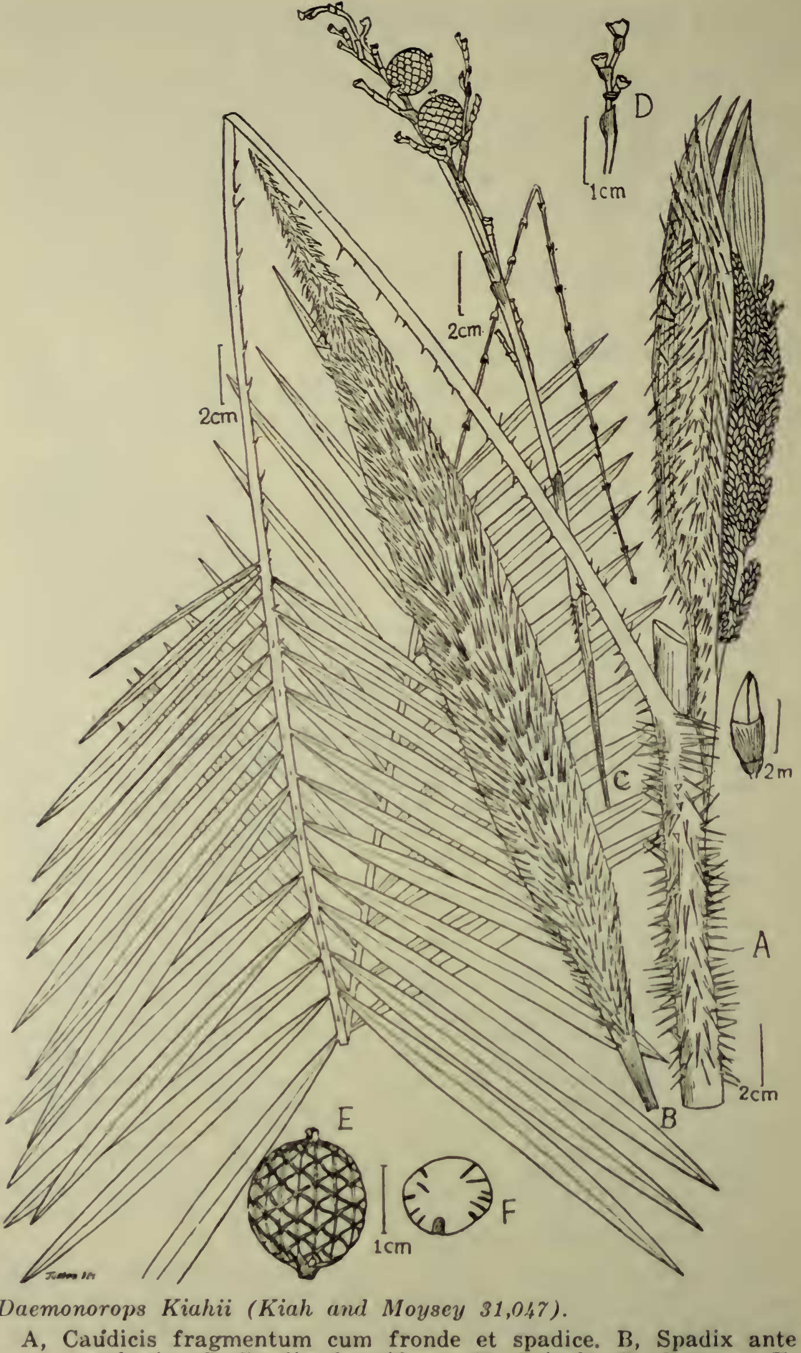
Daemonorops Kiahii Furtado **sp. nov.**

A *D. sepal* cui valde affinis, differt fructibus obovato-oblongis; squamis fructus latioribus quam altis, foliolis brevioribus.

Caudex scandens, cum vaginis 2–2·5 cm. in diam. *Vagina* frondis deciduo fusco leprosa, aculeis inaequalibus, schistaceis 10–30 mm. etiam minoribus interpositis, laminaribus, solitariis vel ad basin per series interruptas approximatis per totam superficiem et secus margines apicales armata, infra petiolum gibbosa. *Frondes* cirriferae; in parte pinnifera 50–70 cm., longa; petiolus circa 50 cm. longus, in vagina superiore inermis, applanatus, secus margines et secus dorsi medium aculeis brevibus, solitariis, distantibus preditus; rachiis unguibus solitariis, apicem versus 1–5-natis, armata. *Foliola* plura, aequidistantia, 2–2·5 cm. inter se dissita, linearia, 20–25 cm. longa, 10–14 mm. lata, super secus nervos tres setosa; subtus in nervo mediano tantum setis minutis deciduis praedita, secus margines et apice setosa. *Spadix femineus* cum pedunculo 3–5 cm. longo, bifaciato, secus margines et in latere externali aculeolato, 40–45 cm. longus, ante anthesin fusiformis rostratus; spatha externalis bicarinata, deciduo fusco leprosa, aculeis pluribus angustis, ad 3 cm. usque longis, apicem versus subcriniformibus schistaceis, reflexis, subseriatim armata; spatha secunda deciduo bruneo-furfuracea, aculeis ad 1·5 cm. usque longis, nigrescentibus reflexis vel non, armata; alterae spathae inermes; rami primarii 2–3, circa 6–9 cm. longi, 4–5 spiculis praediti; spathella amplectens, oblique truncata, ligulata. Involucrophorum pedicelliforme, medio nonnihil constrictum quam spathella longius oblique cupulare; involucrum alte cupulare, truncatum; areola valde callosa, conspicue protrudens. *Perianthium fructiferum* subpedicellatum. *Fructus* obovato-oblongus, apice abrupte rostratus, cum basi rostroque 26–28 mm. longis, 15–20 mm. in diam; squamis per series 15–16 verticales dispositis, latioribus quam altis, cinnamomiis, margine atrobrunneis; semen orbiculare, in uno latere applanatum, 15 mm. altum, 15 mm. latum, 12 mm. crassum, leviter ruminatum; embryo subbasilaris. *Spadix masculus* consimilis; flores 5 mm. longi.

Malaya: *Trengganu*, Gunong Padang, alt. 1,300 mm. (Kiah and Moysey 31,047) holotypus ♀; paratypus ♂.

This species belongs to the Cymbospathae Section having pedunculate spadices which in fruit tend to nod. From *D. sepal* this species differs in the shorter leaflets, the obovate-oblong fruits and the fruit scales being broader than long



Daemonorops Kiahii (Kiah and Moysey 31,047).

A, Caudicis fragmentum cum fronde et spadice. B, Spadix ante anthesin. C, Spadix fructiferus. D, Spicula. E, Fructus. F, Semen verticaliter discissum.

(6–7 mm. × 5 mm.). In *D. Scortechinii* the fruits are more or less turbinate though their scales appear to be broader than the vertical measurement. *D. imbellis* is described with fruits somewhat similar, but the leaflets and general shape of the fruit scales appear to be different. In the type specimen of *K. Kiahii* both male and female spadices are found mixed together in the same collection. Only the female specimen with the fruit is the holotype, the other (male) specimen being the paratype.

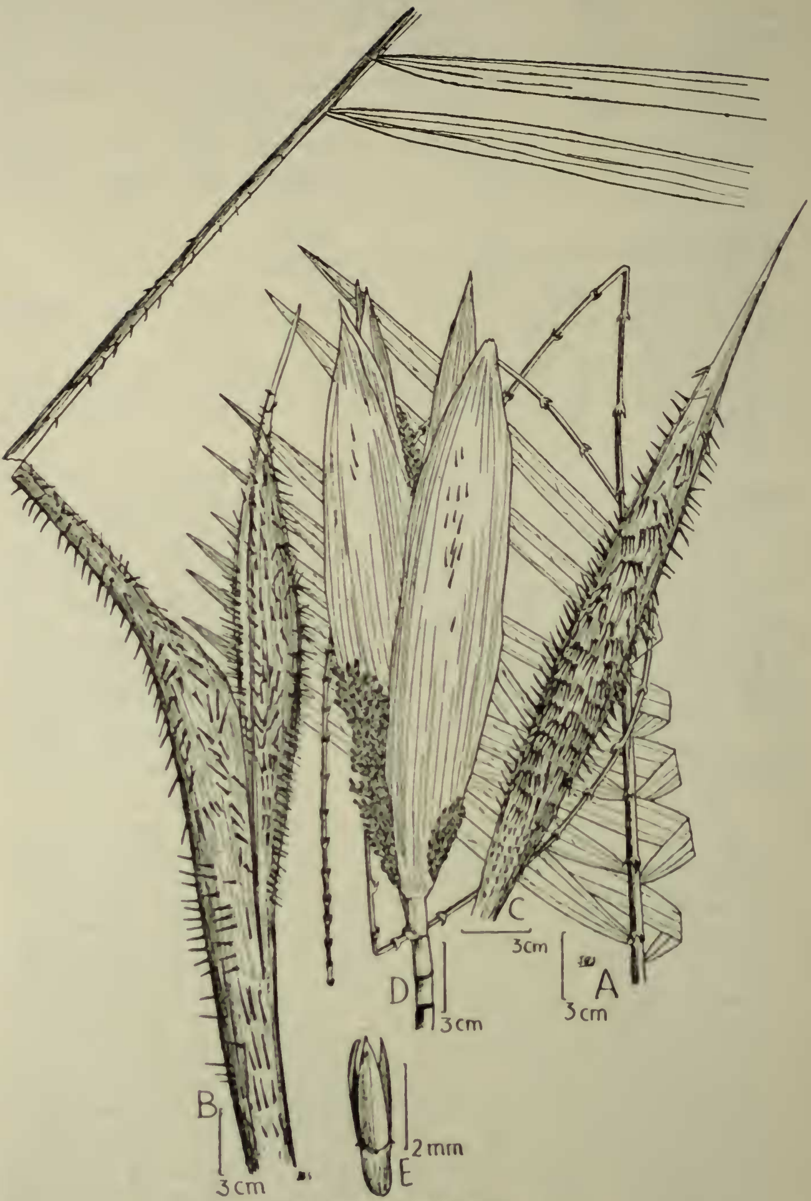
Daemonorops laciniatus Furtado sp. nov.

D. grandis Mart. *sensu* Furtado in Gard. Bull. Straits Settl. IX (1937) 164 p.p.

D. intermedius Mart. *sensu* Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 464 et in Ann. Bot. Gard. Calc. XII (1911) 73 t. 20 p.p.

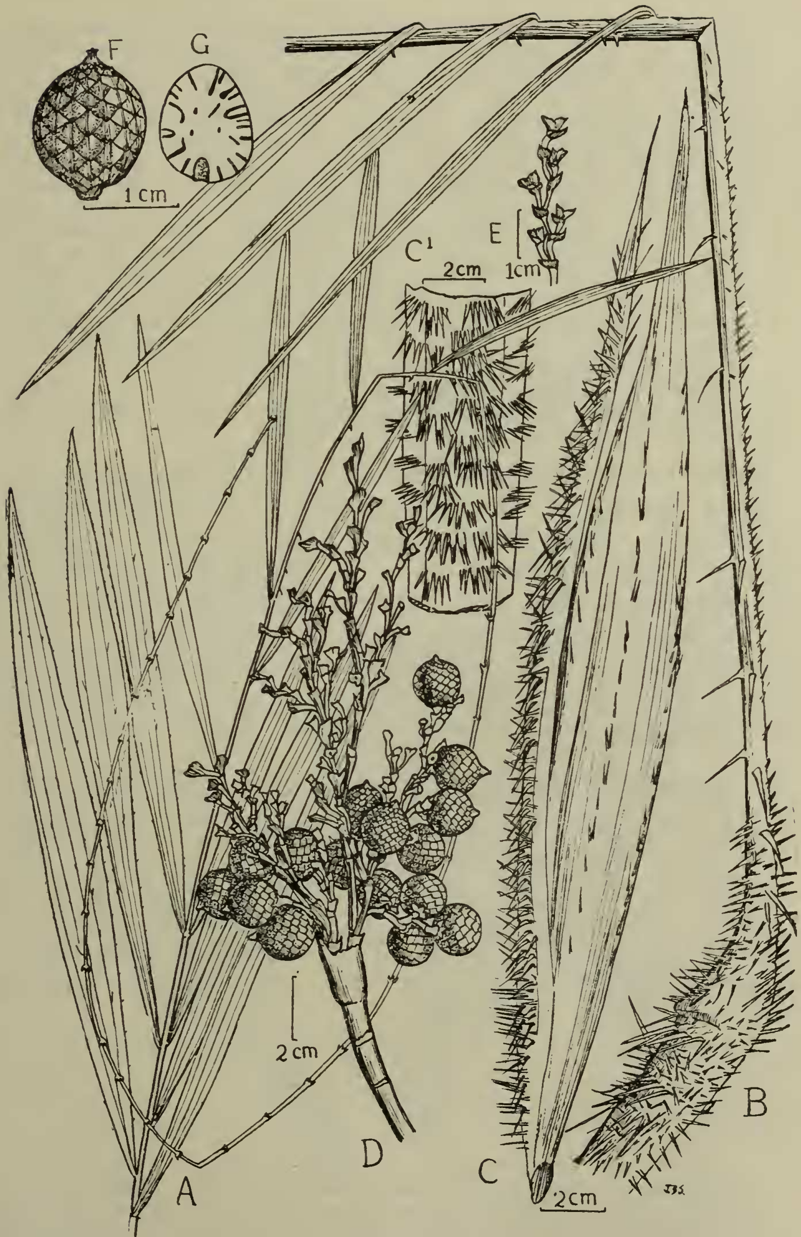
A *D. grande* cui affinissima differt aculeis in frondis vagina inaequalibus, saepe angustioribus et pluribus; foliolis frondis angustioribus; aculeis in spatha externali pluribus, angustioribus, saepe etiam laciniatisque; spadicibus fructiferis minoribus, minus diffusis; squamis fructus per series 17–18 dispositis, minus convexis aspectu generali *D. intermedio* simillima; sed aculeis in spatha externali saepe latioribus, magis rigidis, sed haud per series regulares interruptas dispositis; involucrophoris pedicelliformibus; fructibus ellipticis; squamis fructus haud in 15 series dispositis, dissimillima.

Stem tufted, scandent, 4–7 m. long, with sheaths 2·5–3 cm. in diam. *Leaf-sheaths* gibbous, more or less covered with deciduous tobacco-coloured scurf, armed with unequal, solitary or in interruptedly oblique series, 2–3 cm. long schistaceous spines, frequently with much smaller, subcriniform spines in between the series of the larger ones, the spininess gradually lessened with the age of the plant. *Leaves* 1–2 m. long excluding 50–100 cm. cirrus; petiole 30–60 cm. long, longer ones usually in the lower leaves, armed along the margins on both sides with short unequal, divergent, straight, close or distant spines and along the dorsum with a row of solitary spines, or the lower petiole of the lower leaves irregularly armed in the dorsum; rachis armed with 1–5-nate claws. *Leaflets* numerous, equidistant, 3–5 cm. apart, broadly linear-ensiform, 25–40 cm. long 20–25 mm. broad, gradually narrowed into an acute or acuminate tip; the three nerves more or less bristly above; the midcosta rather closely spinulous in the lower surface, margins spinulous. *Spadices* erect, sessile or obscurely stalked, 25–50 cm. long, beaked, fusiform, male and female similar; the outer spathe bicarinate, cymbiform, covered with tobacco-coloured, decidous scurf, armed externally with numerous, narrowly laminar, or broad and laciniate, solitary or confluent and shortly seriate, 2–4 cm. long spines; second spathe



Daemonorops laciniatus (Furtado 33,045).

A, Frondis fragmentum. B, Petiolus cum vagina et spadice. C, Spadix ante anthesin. D, Spadix post anthesin sine spatha externale. E, Flos masculus.



Daemonorops laciniatus (Furtado 33,016).

A, Frondis fragmentum. B, Petiolus cum parte vaginali. C, Spadix ante anthesin. C¹, Spathis fragmentum externalis ut aculei laciniati vel seriati appareant. D, Spadix fructiferus. E, Spicula. F, Fructus. G, Semen verticaliter discissum.

slightly armed with narrow, blackish spines; the third and sometimes the fourth sparingly armed; spadix without spathes about 10–20 cm. long, 4–6 branched. *Female spadix:* spikelets 3–5 flowered. *Involucrophore* pedicelliform, obliquely subcupular; involucre deeply cupular, truncate; areola distinctly tumescent. *Fruiting perianth* almost explanate, or subpedicelliform at base. *Fruit* about 20 mm. long, 16 mm. in diam., oblong, acute umbonate at apex; scales in 17–18 longitudinal series, straw-coloured whitish in margins, slightly dark-yellowish in the apex and along the fine or obscure intramarginal line. *Seed* ovoid flattened on the side, ventricose on the other, 13–15 mm. long, 12–14 mm. wide, 10 mm. thick; albumen minute with non-ruminate, white core; embryo basal. *Male spadix:* axis of the spikelets strongly zig-zag sinuous, scabrid, deciduously rusty. *Male flowers* oblong, obtuse, about 7 mm. long, 2·5 mm. broad; calyx tubular, 3-toothed; corolla twice as long as the calyx.

MALAYA: *Kedah,* Baling near Reservoir (Furtado 33,045). *Perak,* Kroh (Furtado 33,016, holotypus). *Penang,* Penang Hill (Ridley 11,461).

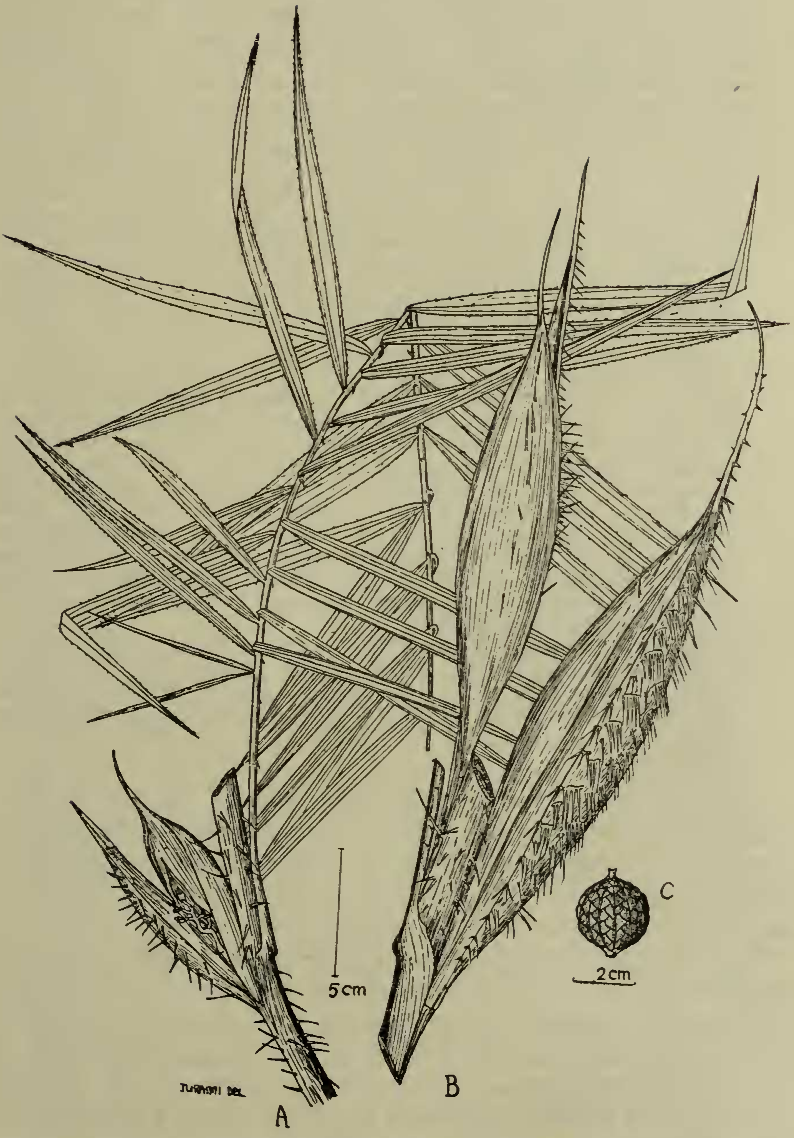
Beccari's description and plates of *D. intermedius* appear to be a mixture of that species and of *D. laciniatus* and *D. grandis.* In plate 20 the right hand specimen with the detached spathe appears to be *D. laciniatus,* whereas the other specimen and that depicted in pl. 21 appear to be *D. grandis. D. laciniatus* resembles very much *D. intermedius,* but the latter is distinguished by its finer spines on the spathes, shorter involucrophores, more globose fruits and the scales being arranged in 15–17 longitudinal series.

Daemonorops Lewisianus (Griff.) Mart., Hist. Nat. Palm. III (1850) 327 t. 175–IV f. 1–7 excl. specimen Gaudichaudianum; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 465; Ridl., Mat. Fl. Mal. Pen. II (1907) 176 p.p.; Becc. in Ann. Roy. Bot. Gard. XII (1911) 87 t. 30 p.p.; Ridl., Fl. Mal. Pen. V (1925) 38 p.p.; Furtado in Gard. Bull. Straits Settl. IX (1937) 171 p.p. excl. syn. *D. microthamnus* Becc., and *D. petiolaris.*

D. Curtisii Furtado in Gard. Bull. cit. IX (1937) 164.

D. monticolus var. *pinangianus* Becc. in Ann. cit. XII (1911) 85 t. 20 p.p. (ex altera parte = *D. tabacinus*).

Stem erect to subscandent, with sheaths 2 cm. in diam. (possibly much thicker in the living state cf. Griffith's picture). *Leaf-sheaths* gibbous below the petiole, provided with an ocrea having horizontally truncate wings at its apex, armed with a few, flat, laminar, elastic 2·4 cm. long, solitary or almost obliquely confluent at bases, spines, usually unarmed at the mouth and on the geniculum. *Leaves* variable with age; the radical leaves 2–3 m. long, almost as the stem, ecirrate at apex, long petioled having regularly set leaflets in the rachis; other leaves shortly cirrate 25–75 cm. long without the cirrus; petiole 6–25 cm. long terete,



Daemonorops Lewisianus (A and C. Ridley 7,896; B. Ridley 7,900).

A, Caudicis fragmentum cum spatha et folio. B, Caudicis fragmentum cum spadicibus. C, Fructus.

armed along the margins with short spreading spines, and along the upper part of the dorsum with short distant, solitary, reflexed spines which continue also in the rachis. *Leaflets* in the radical leaves numerous closely set, about 50 cm. long, nearly 2 cm. broad, bristly along the three nerves above, and only along the middle nerve below; the leaflets of other leaves numerous, closely set, equidistant, 10–20 cm. long, up to 10 mm. wide, 15–30 mm. apart, bristly in the main 3 nerves above, at least in the upper portions, and often on the midvein below. *Spadices* usually approximate at the summit of the stem, shortly stalked, fusiform or ventricose, beaked, erect, the largest about 25–35 cm. long including the beak; outermost spathe cymbiform, deciduously furfuraceous, two-keeled, with a beak half as long as the body, armed with solitary or subseriate narrowly laminar or subcriniform, blackish spines; second spathe often spiny especially in the apical portions and the two keels; other primary spathes glabrous. *Female* spadix divided into a few, short, porrect branches, each with 2–3 spikelets; secondary spathes bracteiform, annulate, ligulate; spathels annular, ligulate striate. *Involucrorophore* 2–5 mm. long expanded into a cupular, one-sided, ligulate-apex; involucre deeply cupular, truncate, entire or obsoletely bidentate; areola almost orbicular, swollen. *Female flowers* ovate, 6 mm. long. *Fruiting perianth* explanate. *Fruit* globose to oblong, suddenly beaked, 18–20 mm. long, 12–15 mm. in diam.; scales arranged in 15 series, channelled, straw coloured, shining, with broad, pale erose margin and a dark spot on the apex. *Seed* ovate-oblong, 10 mm. in diam., 11–12 mm. long, deeply ruminate; embryo basilar. *Male spadices* somewhat similar to the female; spikelets numerous, 1–2 cm. long; involucre deeply cupular, truncate. *Male flowers* 5 mm. long; perianth striate, corolla nearly twice as long as the calyx.

MALAYA: *Penang*, Penang Hill (Ridley 7,034; 7,895; 7,896; Abrams in June 1893); Balek Pulau (Ridley 7,900); Penara Bukit (Curtis July 1893); loc. incert. (Curtis 2,232). *Province Wellesley*, Bukit Juru (Ridley 7,003); Tasek Glugor (Curtis in April 1904, Holotype of *D. Curtisii*). *Perak*, Kroh (Furtado 33,039).

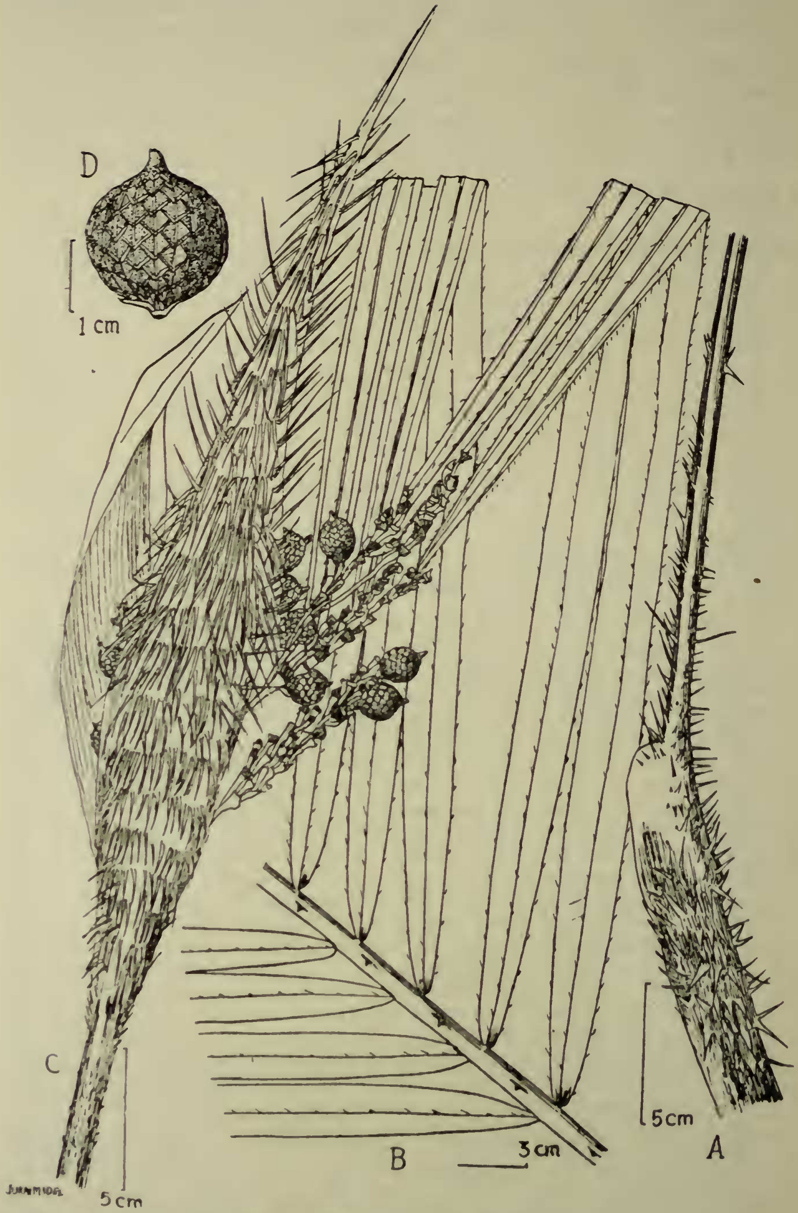
Going through the Singapore herbarium specimens carefully, I was able to clear up some mixtures in mounting, with the result that I have transferred some specimens which I formerly referred here to *D. calicarpus*. There is so much variation in these species that without fruits it is often not easy to determine specifically; better specimens are needed to discover vegetative characters that would distinguish between these species. The drawing given by Griffith does not appear to be accurate, and no specimen in the Singapore Herbarium showed as thick a stem as represented by Griffith. Perhaps this picture is a representation based on the specimens, but altered to the measurements given by Lewis of the base of the stem having the radical leaves. Fruits of the type specimen were supplied by Griffith to Martius who described and figured them as having straw-coloured scales with pale whitish margins and a dark spot on the apex. This description has been confirmed by Beccari who had examined the type-fruit attached by Martius to the sheet of Gaudichaud's specimen from Penang; this sheet is preserved in the Paris herbarium. This character of the fruit scales is very important in separating it from *D. calicarpus* and *D. tabacinus,* which have fruits with cinnamon brown scales. *D. Curtisii* is only a depauperate form of *D. Lewisianus.*

Daemonorops melanochaetes Bl. in Roem. et Schult., Syst. Veg. VII (1830) 1,333 exclu. syn.; Mart., Hist. Nat. Palm. III ed. 1 (1836) 198 t. 117 f. II et ed. 2 (1850) 203 et 326; Kunth. Enum. Pl. III (1841) 202; Bl., Rumphia II (1845 ?) tt. 134 et 137 et III (1849) 3; Becc. in Ann. Roy. Bot. Calc. XII (1911) 47; Furtado in Gard. Bull. Str. Settl. IX (1937) 137.

D. Schmidtianus Becc. in Schmidt, Fl., Koh Chang IX (190) 330 et in Ann. cit. XII (1911) 52 t. 7.

Calamus melanochaetes (Bl.) Griff. in Calc. Journ. Nat. Hist. V. (1844) 86 et Palms cit. (1850) 92 in nota.

Stem scandent, apparently tufted, fruiting when quite small, with sheaths about 3 cm. through. *Leaf-sheaths* rather elongate, fugaciously furfuraceous, armed with flat, schistaceous or blackish, unequal, more or less seriate spines, obliquely truncate and often armed with long spines at the mouth. *Leaves* large, cirriferous; petiole variable, 15–45 cm. long somewhat channelled at the base above, more or less prickly on the dorsum below and along the margins above. *Leaflets* numerous equidistant, linear-ensiform, alternate or sub-opposite, 25–60 cm. long, 10–25 mm. broad, central and the lateral veins bristly on the upper surface, closely but deciduously bristly on the midcosta alone on under surface or smooth, ciliate in the margins. *Spadix* male and female somewhat similar, broadly or ventricosely fusiform, erect, more or less peduncled; outer spathe cymbiform, covered with deciduous dark or tobacco-coloured scurf, armed with long, very narrowly triangular or subcriniform, often paler tipped, solitary or united in short series at base, spreading in many directions, spines; beak about as long as the body or shorter, often unarmed towards its apex. The second spathe more or less spinous; the third occasionally armed towards the apex only, but usually like the subsequent ones. *Female spadix* with 4–7 branches, each bearing a few spikelets at the base; spikelet axis sinuous with 5–7 distichous flowers. *Involucrophorum* oblique, subconical; involucre shallowly cupular, truncate entire; areola distinct, tumescent. *Fruiting perianth* explanate. *Fruit* elliptic and beaked when not fully mature, later globose, shortly umbonate, 15–17 mm. in diam.; scales arranged in usually 18–21 vertical series, rarely 15–16, channelled along the middle, rather dull cinnamon brown, with non-spotted apex and a darker uniform intramarginal line. *Seed* irregular, ovoid, slightly broader than tall, 12 mm. in height, 13 mm. broad, 10 mm. thick, deeply ruminate; embryo



Daemonorops melanochaetes (Henderson 21,710).

A, Fragmentum petioli cum vagina. B, Fragmentum frondis. C, Spadix fructiferus. D, Fructus.

basal. *Male spadix* often larger than the female, densely panicled, cupressiform, rusty-furfuraceous in every part; spikelets many flowered 5–6 mm. long; corolla twice as long as the calyx.

MALAYA: *Penang,* Moniots Road (Ridley 9,466). *Province Wellesley,* Bukit Juru (Ridley 7,100). *Negri Sembilan,* Gunong Tampin (Holttum 9,561; Goodenough 1,857). *Malacca,* Bukit Dusun Paya (Alvins 1,217 as *Rotan Miniak*). *Johore,* Bukit Soga Ridley 11,205 partim) Serom (Ridley in 1900) Pulau Aor (Henderson 18,358). *Pahang* on Pulau Tioman, Sedagong (Nur 18,891); Bukit Surin (Henderson 21,710); Joara Bay (Burkill 983 and 1,016).

DISTRIBUTION: Siam, Sumatra, Borneo and Java.

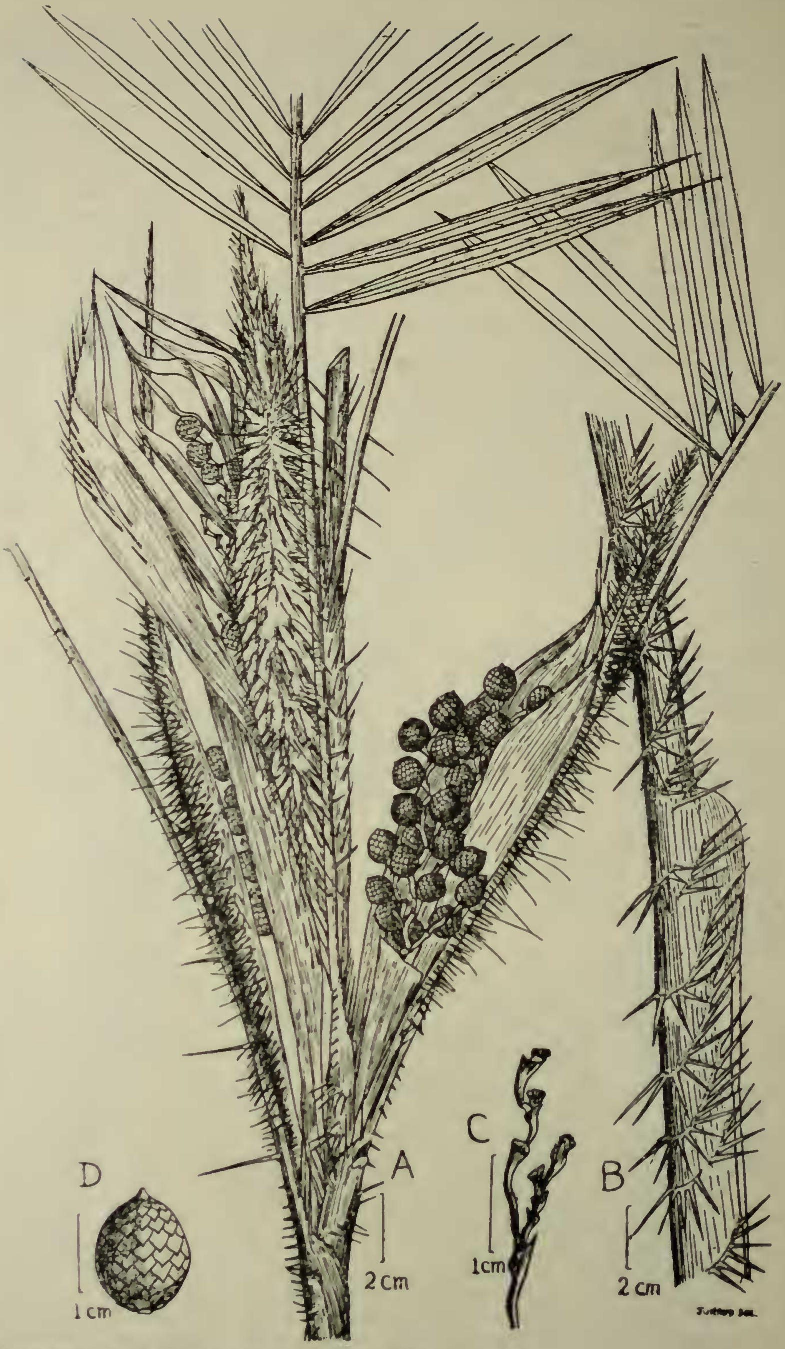
There are many forms and varieties of this species, but better collections and field studies are needed to clear these up. The size, shape and the armature of the spadix vary considerably and many of these variations appear to be due to age and environment. The Malayan form of *D. melanochaetes* does not appear to be short-stemmed and so somewhat like the Javanese long stemmed form. Ridley 11,205 (male) and Ridley 9,466 represent *D. melanochaetes* as interpreted by Beccari. Ridley 11,205 (female) is *D. monticolus.*

Daemonorops monticolus (Griff.) Mart., Hist. Nat. Palm III (1850) 328 t. 175 f. V; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 465; Ridl., Mat. Fl. Mal. Pen. II (1907) 176 p.p.; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 84 p.p.; Ridl., Fl. Mal. Pen. V. (1925) 37 p.p.; Furtado in Gard. Bull. Straits Settl. IX (1937) 176 p.p.

D. intermedius Mart. *sensu* Furtado op. cit. p. 168 p.p.

Calamus monticolus Griff. in Calc. Journ. Nat. Hist. V (1844) 90 et Palms Brit. Ind. (1850–97) tt. 214 A and B, excl. C.

Stem tufted, erect or subscandent, 2·5 m. high, with sheaths about 2·5 cm. in diam. *Leaf-sheaths* covered with deciduous tobacco-coloured scurf, armed with long sub-equal, up to 3 cm. long, flat, subulate, schistaceous, scattered or subseriate, usually non-confluent thorns, obliquely truncate at the mouth, armed at the base or the petiole, and sometimes a little below the marginal rim of the mouth of the sheath, with long porrect spines. *Leaves:* upper ones cirriferous; petiole about 25 cm. long, 6–10 mm. wide, slightly channelled above, gibbous at base, armed along the margins and in a dorsal row with long, distant spines with many short ones toward the base, the dorsal claws becoming shorter as the leaves approach the topmost summit of the stem; the claws on the pinniferous rachis short, 1–3-nate. *Leaflets* equidistant, linear, alternate to opposite, numerous, 20–25 cm. long, 10–15 mm. broad, in the upper surface bristly in the three nerves (less in the midnerve than in the two lateral ones), on the lower surface armed in the midvein alone with weak, brittle or deciduous bristles; margin and apex bristly. *Female spadix* erect, fusiform shortly stalked, 30–40 cm. long, beaked; the outer spathes



Daemonorops monticolus (Ridley 11,205).
A, Caudicis fragmentum apicale. B, Frondis fragmentum juvenilis cum vagina. C, Spicula. D, Fructus.

covered with deciduous black scurf when young, bicarinate, armed with weak, long, narrow, flat or subcriniform, deflexed, irregularly scattered or subseriately arranged, blackish spines; the second spathe armed towards the upper half with subcriniform spines; branches 3–5; spikelets 3–5 cm. long, with sinuous axis. *Involucrophore* short, broadly and obliquely cupular; involucre shallowly cupular, slightly one-sided, lower than the apex of the involucrophore on one side; areola distinctly swollen, especially on the upper side, often sunk deep between the projecting margins of the involucral and the involucrophoral cups. *Fruiting perianth* explanate. *Fruit* globose, conically beaked when young, roundish umbonate when mature, 15 mm. in diam.; scales arranged in 15 vertical series, cinnamon brown with dark intramarginal line and erose margins. *Seed* orbicular, flattened on one side, as tall as it is broad, 11–13 mm. broad, 10 mm. thick, ruminate, with embryo slightly above the base. *Male spadix* unknown.

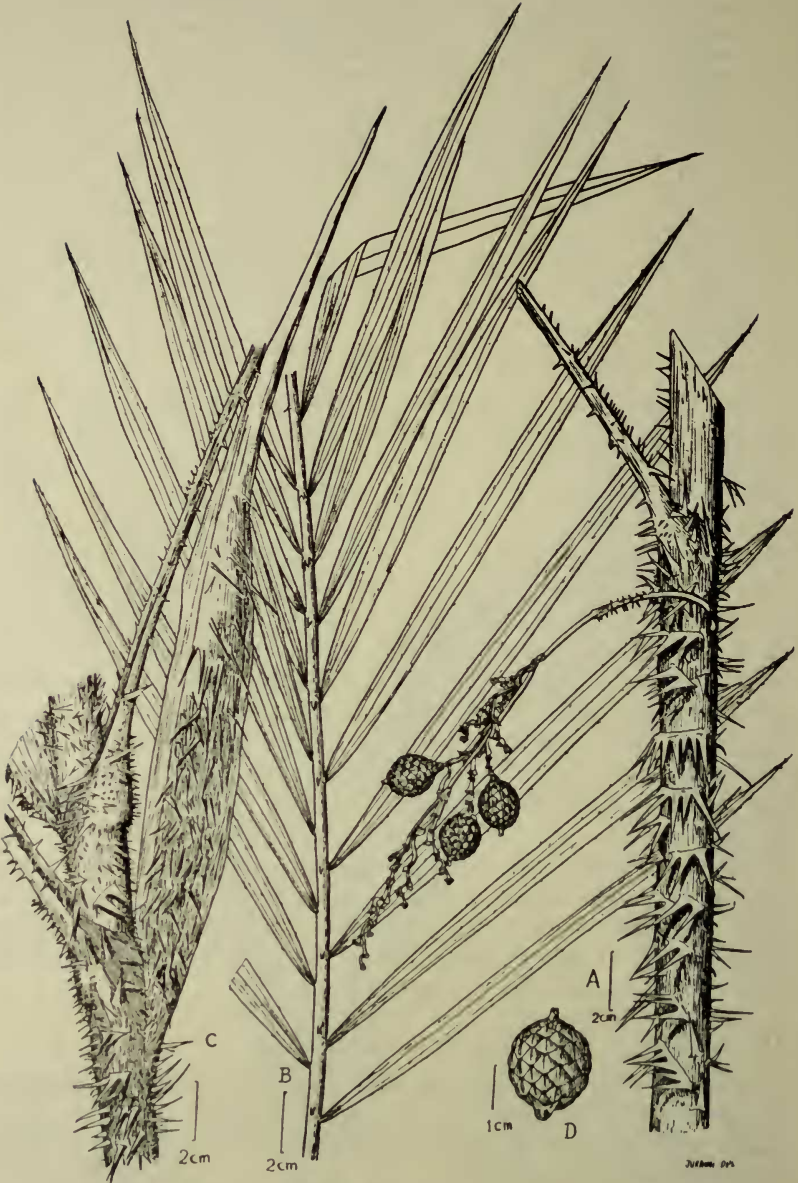
MALAYA: *Johore*, Bukit Soga (Ridley 11,205, partim—neotype); Gunong Pulai (Mat. 3,720).

The description given here is based on Ridley 11,205 (female) with the exception of that of the mature fruits which is derived from Mat. 3,720. Though in general appearance Ridley 11,205 seems to match Griffith's 214B, some discrepancies are observed; Griffith's plate and description represent the second spathe as unarmed, where it is armed in Ridley 11,205. Both Martius and Beccari describe the fruit as having the scales arranged in 18 vertical series, whereas in both the specimens studied by me the scales are in 15 vertical series. From the English description and the plate given by Griffith it is obvious that the first words of Griffith's Latin diagnosis should be 'Spatha extima *inter et* secus carinas duas', the italicised words having been omitted in the text apparently through an error. Perhaps Griffith's plate 214C represents the Penang specimen. According to Griffith the fruit scales in the Penang specimen are 'green with white margins and a brown intra-marginal line' a reason why I consider this Penang specimen as *D. Lewisianus*. In his interpretation of *D. monticolus,* Martius also had excluded the Penang specimen.

Daemonorops Nurii Furtado **spec. nov.**

A *D. singalano* cui affinissima, fructibus obovato-oblongis, squamis fructus secus margines albescentibus, infra margines gracile atro-luteis vel brunnescentibus, apice fuscencentibus sat distincta.

Caudex scandens, cum vaginis 2–3 cm. in diam. *Vagina* frondis fusco deciduo furfuracea, apice oblique truncata, infra petioli basin geniculata, in geniculo breviter aculeata, secus margines spinis longis, erectis praedita, inter marginem et geniculum utrinsecus nuda vel spinis brevibus armata; in altera parte spinis



Daemonorops Nurii (Nur 32,853).

A, Caudicis fragmentum cum spadice fructifero. B, Fragmentum frondis. C, Fragmentum caudicis ut spadix ante anthesin appareant. D, Fructus.

inaequalibus, schistaceis reflexis, solitariis vel saepe basi oblique approximatis vel subseriatim confluentibus, late laminaribus vel etiam subcriniformibus, ad 3 cm. longis usque armata. *Frondes* cirriferi; 1–2 m. longi; petiolus 12–25 cm. longi, supra applanatus, subtus convexus, secus margines in utra pagina spinis robustis solitariis vel digitatis armatus, dorso (infima parte basali magis armata excepta) aculeis solitariis reflexis praeditus; rachis pinnatifera subtus unguibus solitariis vel digitatis armata. *Foliola* alternata vel subopposita, aequidistantia, linearia, 25–30 cm. longa, 12–16 mm. lata, apice subulato acuminata, supra in costa primaria et duabus costis subprimariis setosa, subtus in costa mediana tantum setis minutis, deciduis vel fragillimis et in marginibus setis appressis praedita. *Spadix femineus* ante anthesin fusiformis cum pedunculo 3–4 cm. longo, spinis brevibus armato, et cum rostro corpori equilongo vel quam hoc breviore, 30–35 cm. longus, cum fructibus nonnihil reflexus; spatha externe bicarinata, deciduo fusca furfuracea, in corpore spinis anguste laminaribus, subaequalibus, schistaceis, solitariis dispersis, vel basi approximatis armata, in rostrum 10–14 cm. longum inerme vel fere terminata; spathae alterae inermes; spadicis axis sine pedunculo spathisque circa 15 cm. longa; rami primarii 3–4, porrecti, 4–5 cm. longi, in spiculas 3–4, floribus 4–6 praeditas, 2–3 cm. longas, divisi. *Involucrophorum* breve, quam spathella paulo longius, oblique truncatum, subcupulatum; involucrum cupulare truncatum involucrophoro paulo brevius; areola callosa. *Flores feminei* ovati, circa 8 mm. longi, basi truncati; calyx cupularis, valde striatus, superficialiter 3-denticulatus, quam corolla demidio brevior. *Perianthium fructiferum* pedicelliforme; calyx paulo divisus, cupuliformis. *Fructus* immaturi tantum visi, obovato-oblongi, apice abrupti rostrati, sine rostro circa 18 mm. longi, 10–12 mm. in diam.; squamis in series verticales 15 dispositis stramineis, secus margines albescentibus, infra margines gracillimo fusco-luteis vel obscuris, apice fuscescentibus; *Semen* immaturum characteribus permanentibus nondum evolutis.

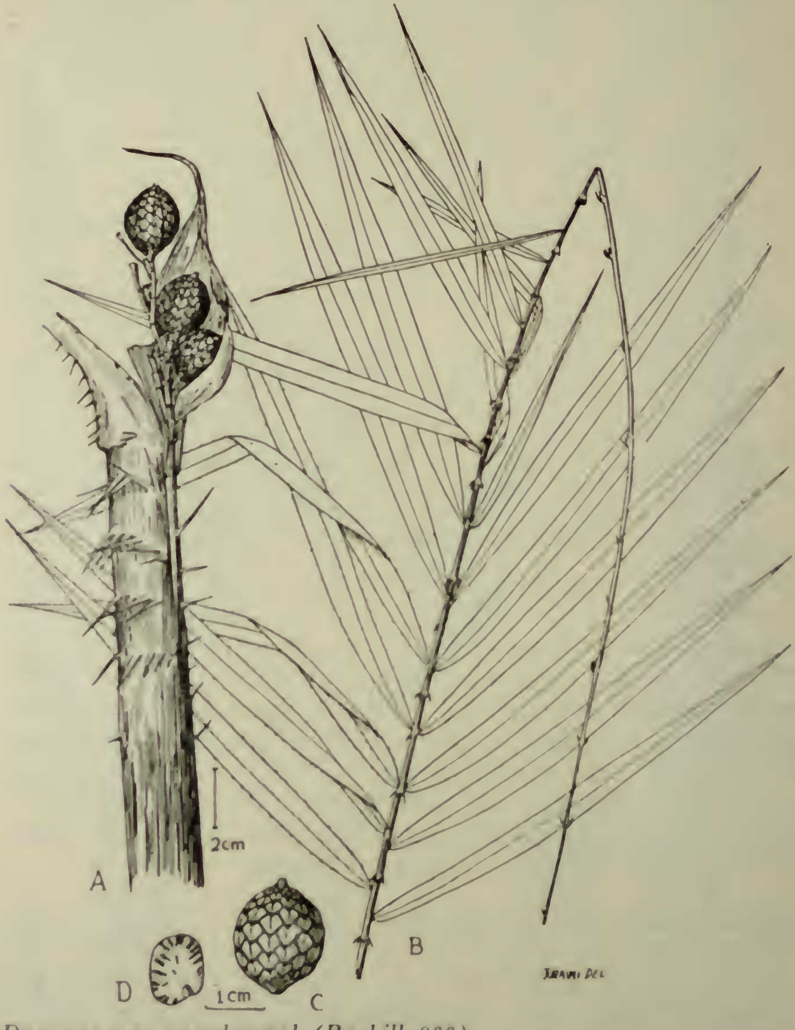
MALAYA: *Pahang*, Cameron Highlands, alt. 2,500 m. (Nur 32,853).

This resembles very much *D. singalanus* of Sumatra, but differs from it by its obovate-oblong fruits, and fruit scales having whitish margins. In the lower parts of the stems the sheaths are long and the spines are arranged more or less in oblique series, but this arrangement becomes less conspicuous in the terminal parts of the stem. In the lower parts of the stem the bare portion on either side of the geniculum is not present and the petioles are longer.

Daemonorops pseudo-sepal Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 465; Ridl., Mat. Fl. Mal. Pen. II (1907) 180; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 79 t. 25; Ridl., Fl. Mal. Pen. V (1925) 40 inter species dubias; Furtado in Gard. Bull. Straits Settl. IX (1937) 177.

D. bakauensis Becc. in Ann. cit. XII (1911) 221. t. 100.

Stem scandent, 3–5 m. long, with sheaths 15–20 cm. in diam. *Leaf-sheaths* covered with deciduous tobacco-coloured scurf, obscurely ridged longitudinally, armed with distant, unequal, 2–3 cm. sometimes longer, flat, more or less obliquely confluent, schistaceous spines; unarmed at the mouth. *Leaves* about 1·50 m. long excluding the cirrus; petiole 35–50 cm. long, armed along the margins with short, scattered spines, and along the dorsum with solitary claws along dorsum in the basal half and with 2–5-nate claws in the terminal one, unarmed in the upper surface. *Leaflets* numerous, equidistant, 3–5 cm. apart, opposite or alternate, ensiform, 25–35 cm. long, 14–16 mm. broad, not



Daemonorops pseudosepal (Burkill 866).

A, Caudicis fragmentum cum spadice fructifero. B, Frondis fragmentum apicale. C, Fructus. D, Semen verticaliter discissum.

or very slightly bristly in one or all the three nerves above, bristly only in the midcosta below or entirely smooth, appressedly spinulous along the upper half of the margins. *Female spadix* without external spathes 8–12 cm. long, erect, shortly peduncled, with 2–3 branches; external spathe not known; other spathes smooth; involucrophore short, subcupular, one-sided; involucre cupular, truncate, entire, almost immersed in the involucrophore; areola distinctly swollen. *Fruiting perianth* almost explanate. *Fruit* ovoid-elliptic to almost spherical, with a mucronate beak; 17–22 mm. long and nearly as wide; scales arranged in 15–16 series channelled, with dark intra-marginal line, and a very dark tip. *Seed* somewhat flattened, suborbicular, almost equally convex on both surfaces, about 10–12 mm. tall, as much broad, 7–9 mm. thick, ruminate, with a basal embryo.

MALAYA: *Johore,* Pulau Tinggi (Burkill 866). ? *Singapore,* Bukit Timah (Ridley in 1894).

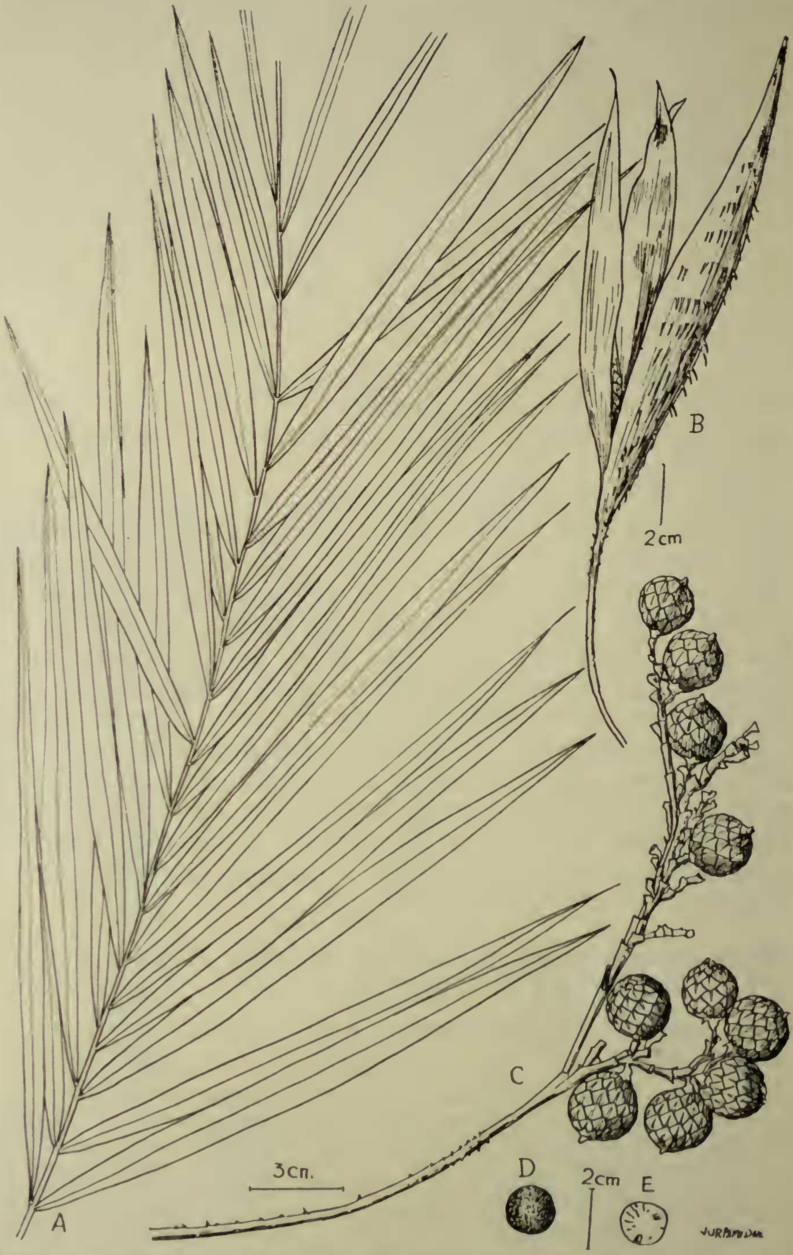
This species may be a depauperate form of *D. laciniatus.* Its syntypes were from Perak where the species has not been collected again. *D. laciniatus* has been found frequently in Perak.

The external spathe of *D. pseudosepal* is not yet known and without this it is not easy to decide precisely the affinities between these two species. Ridley's collection from Singapore has been quoted here with some doubt; this was quoted as *D. grandis* in Ridley's *Materials* II (1907) and his Flora V (1925). It differs from the Johore specimen quoted above in that the stem, the spadix-axis and the spadix-branches are much more slender in this than in the Johore specimen, the fruit scales arranged in 16 series (15 in the type) and the leaflets are smooth on both surfaces except for a few occasional bristles on the upper half of the midnerve in upper surface. This specimen appears to have been derived from a plant that just started to flower and fruit for the first time.

Daemonorops Scortechinii Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 81 t. 27.

D. sepal var. *sphaerocarpus* Becc. in Rec. Bot. Surv. II (1902) 220.

Stem unknown. *Leaves* cirriferous; petiole unknown; rachis armed below in its upper parts with 2–3-nate claws. *Leaflets* numerous equidistant 15–18 mm. apart, linear or linear-lanceolate, 22 cm. in length, 11 mm. in width; the midcosta and one nerve on each side of it bristly; beneath midcosta alone sparingly bristly; margins finely and appressedly spinulous. *Female spadix* fusiform shortly beaked, 20 cm. long, stalked, nodding in fruit; outer spathe almost equally narrowing towards both ends (beak about 4 cm. long), armed with narrowly laminar, rather short (5–10 mm.) feeble, deflexed, often seriate spines; inner spathes unarmed; branches few, 6–7 cm. long with a few spikelets. *Involucrophore* subconic, thick and short, callous at its axilla,



Daemonorops Scortechinii (ex tab. Beccarii delineata).
A, Pars frondis. B, Spadix anthe anthesin. C, Spadix fructiferus.
D, Semen. E, Semen verticaliter discissum.

unilateral, subcupular; involucre cupular, truncate, entire, almostly entirely immersed in the involucrophore; areola depressed, conspicuously swollen in the upper margin. *Fruiting perianth* subpedicellate. *Fruit* obovoid globular, 2 cm. in diam. narrowed towards the base or subturbinate; scales in 15–16 vertical series, tawny-brown, with a sharp, dark marginal line, deeply channelled along the centre, and with a slightly produced tip. *Seed* globular 14–16 mm. in diam., not strongly ruminate; embryo basal.

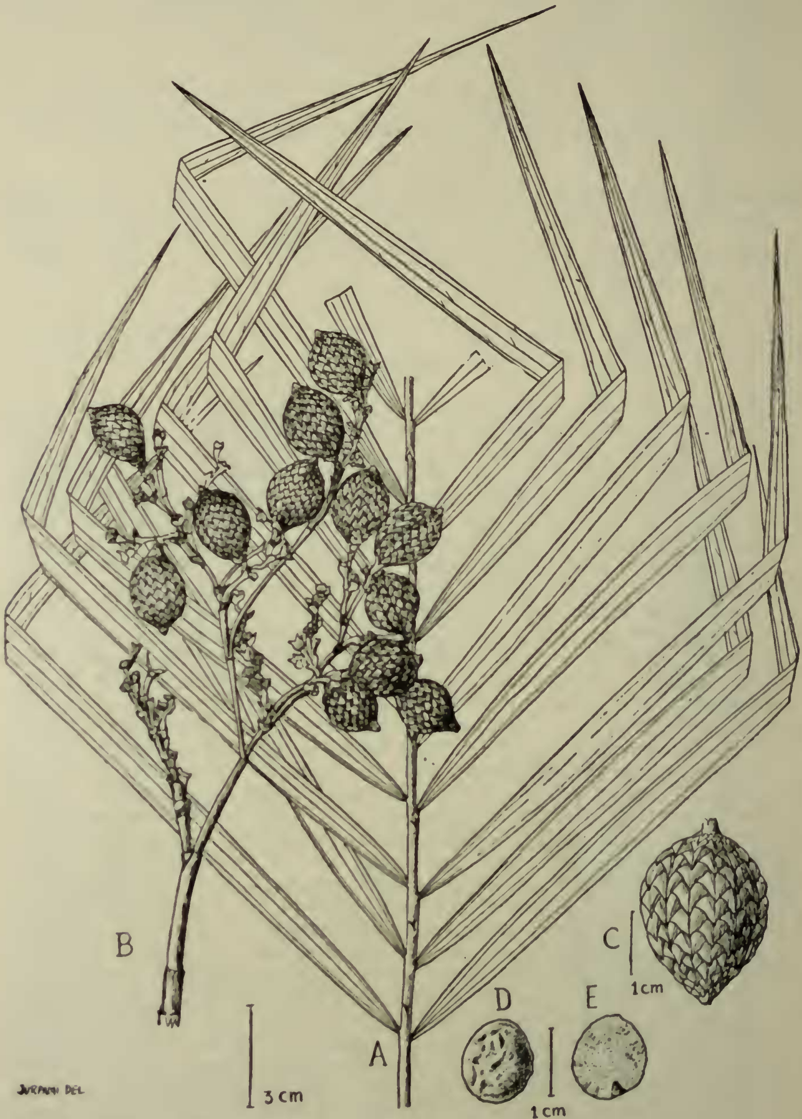
MALAYA: *Perak,* loc. incert. (Scortechini s.n.).

This species is known only from the type specimen. I know this species only from Beccari's description and plate.

Daemonorops sepal Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 465 et in Ann. Roy. Bot. Gard. Calc. XII (1911) 77 t. 24; Ridl., Fl. Mal. Pen. V (1925) 36; Furtado in Gard. Bull. Straits Settl. IX (1937) 178. p.p.

D. aciculatus Ridl., Mat. Fl. Mal. Pen. II (1907) 176 et Fl. cit. V (1925) 38. **Syn. nov.**

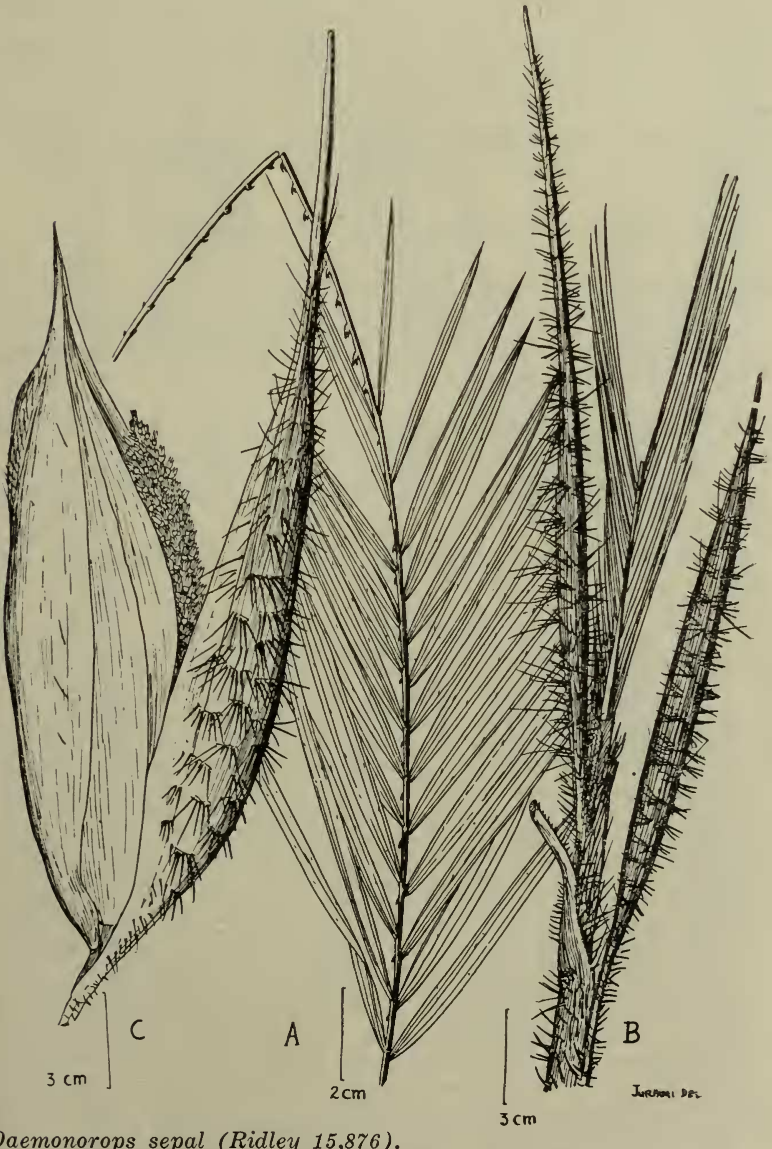
Stem scandent with sheaths 15–20 mm. in diam. *Leaf-sheaths* gibbous above, covered with deciduous dark brown scurf, armed densely but irregularly with narrow laminar, schistaceous, unequal, up to 3 cm. long, porrect or pointing in all directions, scattered or disposed in short, interrupted, oblique series, spines. *Leaves* 50–100 cm. long in the pinniferous part; cirrus short; flattened above, more or less prickly on the upper surface, especially along the margins; on the under surface variously armed along the margins and the dorsum with solitary or approximate spines; the rachis armed on the lower surface with solitary spines in the lower parts, 3–5-nate in the terminal one. *Leaflets* numerous, equidistant, 15–20 mm. apart, linear or linear-lanceolate, subtricostulate, all the three nerves bristly above, the midcosta alone minutely bristly in the lower surface; margins spinulous; longest leaflets 25–35 cm. long, 10–15 mm. broad. *Female spadix* erect or nodding when in fruit, above 35 cm. long, fusiform before anthesis with an obsolete or upto 5 cm. long, bifaced, spiny edged, peduncle; outer spathe bicarinate, armed with narrow laminar or subcriniform, upto 4 cm. long, scattered or subseriate spines; inner spathes unarmed; primary branches 4–5, porrect, about 5–8 cm. long, with 5–6 short, upto 4 cm. long spikelets, having sinuous axis; spathels bracteiform amplectent, acute or acuminate. *Involucrophore* as long as or shorter than, the spathel, one-sided, subcupular; involucre cupular, truncate, as long as the involucrophore. *Fruiting perianth* broadly obconical, or subexplanate, with corolla twice as long as the calyx. *Fruit* obovate-elliptic, beaked, about 24–30 mm. long, 15–20 mm. broad; scales arranged in 15–18 series, tawny brown with dark brown marginal line, dull or slightly shining, channelled with a triangular, not produced tip. *Seed* oblong 15 mm. long, 12 mm. broad, 10 mm. thick, pitted in the outer surface; albumen brownish white, ruminate; embryo basal. *Male spadix* similar to female, with similarly armed spathes; the main axis and of the branches fugaciously rusty-furfuraceous, the largest primary branch being about 10 cm. long, with many up to 4 cm. long, branchlets; the lower branchlets often subdivided into short about 10 mm. long spikelets, each with 2–3 flowers; higher up the branchlets not divided, but with 8–10 flowers; flower bearing axis zig-zag sinuous; spathels amplectent, deciduously rusty furfuraceous often hairy at apex; involucre nearly as long as the spathel, often cupular, truncate, bidentate, with deciduously hairy teeth. *Male flowers* oblong; calyx half as long as the corolla.



Daemonorops sepal (Ridley leg. in 1892).

A, Pars frondis. B, Spadix fructiferus. C, Fructus. D, Semen. E, Semen verticaliter discissum.

MALAYA: Perak, Gunong Hijau (Ridley in 1892, syntype of *D. aciculatus;* Burkill and Haniff, 12,766); Maxwell Hill (Ridley in June 1893, syntype of *D. aciculatus*); Sungai Mengkarau (Anderson 166 and 176); Birch's Hill (Burkill and Haniff 12,994). *Selangor,* Sempang Mines (Ridley 15,876); Sungai Ikan at Ulu Telom (Dolman 27,631 as *Rotan Baik*); Fraser Hill (Burkill and Holttum 7,785).



Daemonorops sepal (Ridley 15,876).

A, Frondis pars. B, Fragmentum caudicis. C, Spadix dum anthesin.

The following are cited here doubtfully:—

Pahang, Sungai Ikan (Dolman 27,631); Sungai Lenoi (Dolman 28,157). *Perak,* Larut (King's Collector 4,133, syntype of *D. sepal*). Gunong Hijau (Burkill and Haniff 12,763).

There seems to be some difference in the shape and size of the fruits of *D. sepal* and *D. imbellis,* and those specimens cited doubtfully here might be *D. imbellis.* The specimens sometimes are mixed and in the most cases have young fruits. King's Collector 4,133 is one of the syntypes of *D. sepal,* but its fruits which are oblong or elliptic in young stages, have the scales arranged in 15 vertical series. Better specimens are needed to distinguish between this and *D. imbellis.*

D. aciculatus is identical with *D. sepal.*

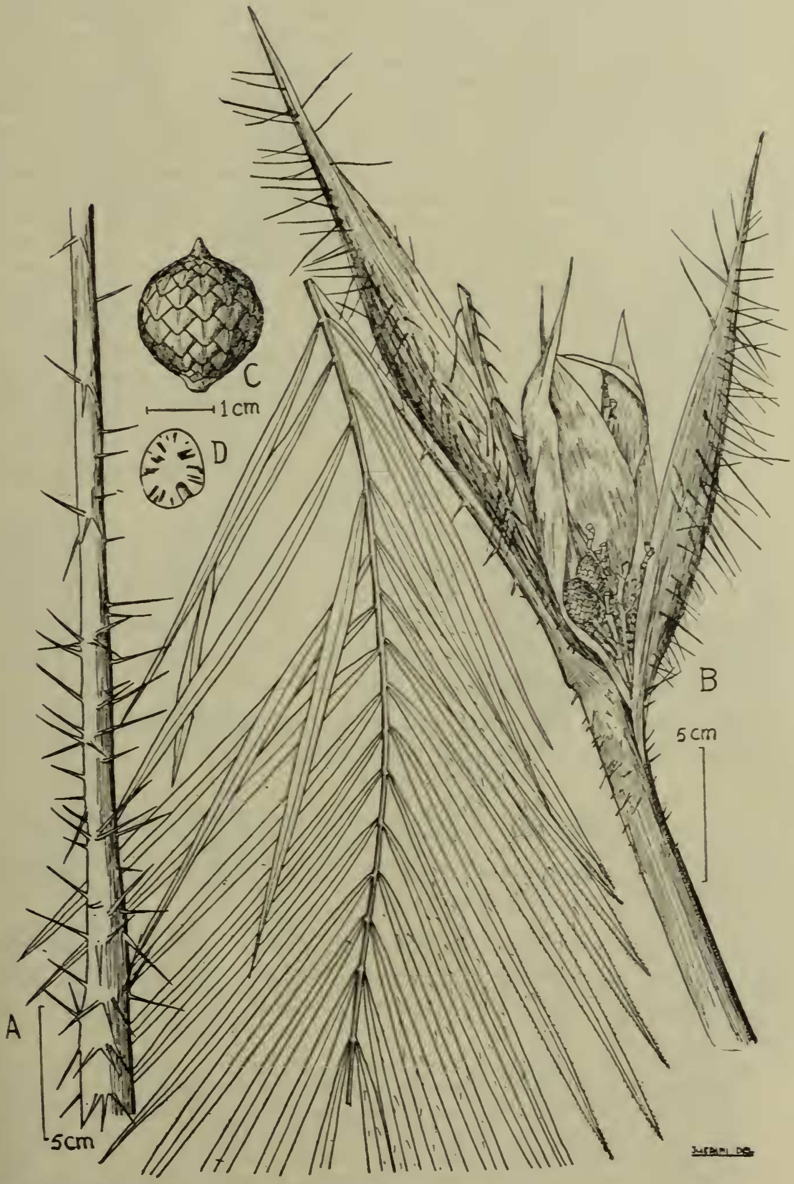
Daemonorops tabacinus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 446, in Rec. Bot. Surv. Ind. II (1902) 222; et in Ann. Roy. Bot. Gard. Calc. XII (1911) 93 t. 33; omnino quoad specimen masculum.

D. calicarpus (Griff.) Mart. *sensu* Ridl., Mat. Fl. Mal. Pen. II (1907) 175 et Fl. Mal. Pen. V (1925) 37 p.p.

D. Lewisianus Mart. *sensu* Furtado in Gard. Bull. Straits Settl. IX (1937) 171 p.p.

D. monticolus var. *pinangianus* Becc. in Ann. cit. XII (1911) 85 p.p.

Stem apparently tufted erect or semi-scandent, up to 4 m. long, with sheaths 2 cm. in diam. *Leaf-sheaths* thickly covered with dark, tobacco-coloured scurf, armed with scattered, laminar, subseriate but distinct spines, unarmed at the mouth and provided with a truncate ocrea. *Leaves:* radical 2 m. or more long, non-cirriferous; petiole very long covered with tobacco-coloured scurf, densely armed in the lower parts with long, flat, obliquely seriate spines, less in the middle, and almost unarmed towards the end except for a few spines along the centre of the dorsum; petiole of the adult leaves 10–15 cm. long, gibbose at the base, armed along the margins and often along the dorsal median line with short, solitary, distant spines; rachis of the radical leaves unarmed or armed with remote solitary spines; rachis of adult leaves about 40 cm. long, armed dorsally with 1–3-nate claws, terminating in a short cirrus. *Leaflets* in radical leaves variable, some 40–50 cm. long, 25–28 mm. wide, other 30–45 cm. long, 15 mm. wide apparently depending on the age of the clump and the individual stem, in the upper surface the midnerve and one on each side bristly, in the lower surface only the midrib thus armed with smaller but closer spines; leaflets in adult leaves closely set, 1·5–2 cm. apart, slightly more apart just above the base, linear, largest in the middle 15–20 cm. long, 1 cm. broad, setose along the margins and in the three nerves above, in the lower surface only the midnerve minutely and more closely setose. *Female spadices* ventricose, fusiform, with a beak as long as or



Daemonorops tabacinus (Burkill 376).

A, Petioli fragmentum juvenilis. B, Caudicis fragmentum apicale. C, Fructus. D, Semen verticaliter discissum.

shorter than the body; outermost spathe covered with dark tobacco-coloured scurf, armed with numerous narrowly laminar or subcriniform, darkish, 2–3 cm. long or sometimes longer, solitary or subseriate spines; the second and third spathes spinous near the apex, externally furfuraceous; branches very close, all axial parts rusty furfuraceous; spathels obliquely obconical, extended on one side; involucre cupular, truncate, slightly oblique, slightly longer than involucrophore; areola distinct with a semicircular border on its upper part, female flowers 7–8 mm. long, ovate with a truncate base; calyx striate, 2/3 as long as the smooth corolla. *Fruiting perianth* not quite explanate, broadly conical. *Fruit* not quite mature, globose ovoid gradually rounded on both sides, abruptly beaked at apex, with beak 20 mm. long, 15–16 mm. in diam; scales in 15–16 vertical series; yellowish brown, slightly channelled along the middle, with darker margins, with no light margins or dark spot; seed orbicular, flattened on one side, 10 mm. high, 10 mm. broad, 7–8 mm. thick, deeply ruminate; embryo basal, slightly to one side. *Male spadix* like the female, in general appearance; panicle thyrsoid with 4–6 branches, longest about 7 cm. long, each with many spikelets; the axis and spikelets densely furfuraceous; involucre large cupular, truncate, bidenticulate; corolla twice as long as the calyx or slightly longer.

MALAYA: *Penang,* Balik Pulau (Ridley 7,902); Waterfall (Burkill 376); Moniots Road (Curtis 764).

King's Collector No. 2,537 (the holotype) is a mixed collection consisting of male and female spadices. *D. tabacinus* has been typified on the male spadix, while the fruiting spadix in the type appears to be of *D. intermedius* or *D. laciniatus,* both of which produce fruits bearing light margined scales having spotted tips.

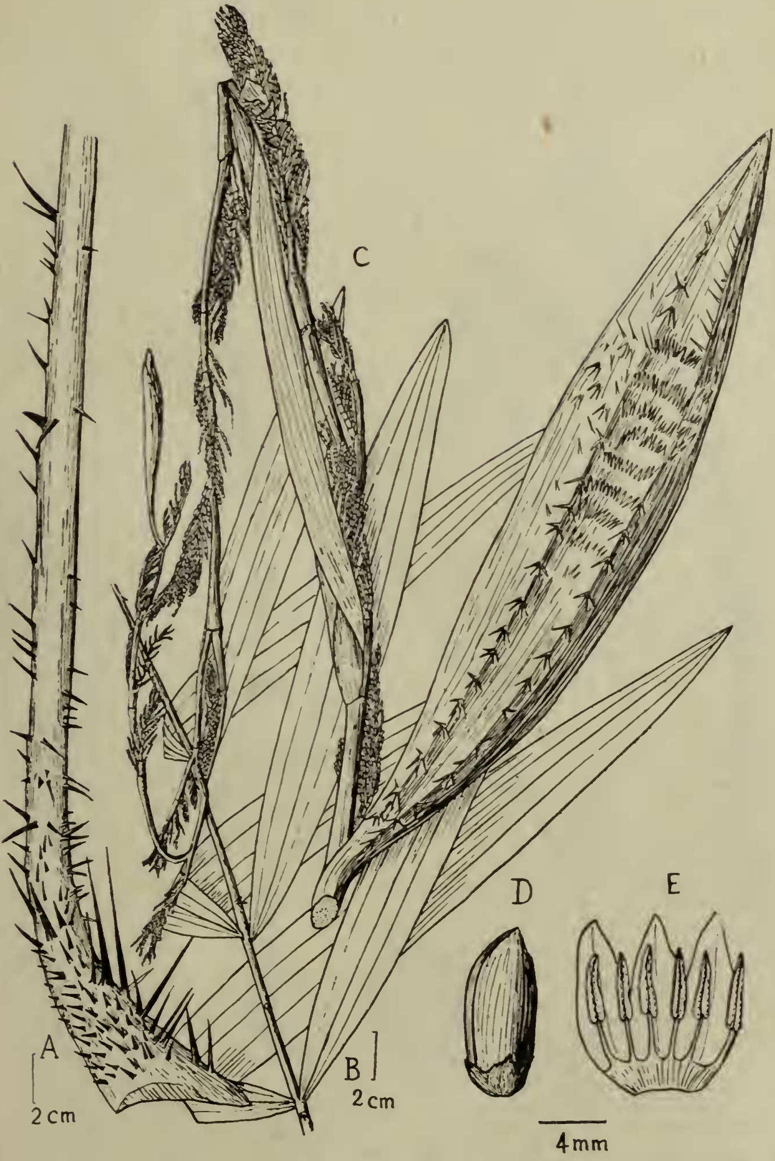
Very near to this species are Alvins 1,217 (Malacca) and Goodenough 1,857 (Negri Sembilan).

B. SPECIES OF THE SECTION PIPTOSPATHA

Daemonorops bracyhstachys Furtado in Gard. Bull. Straits Settl. VIII (1935) 344 t. 37.

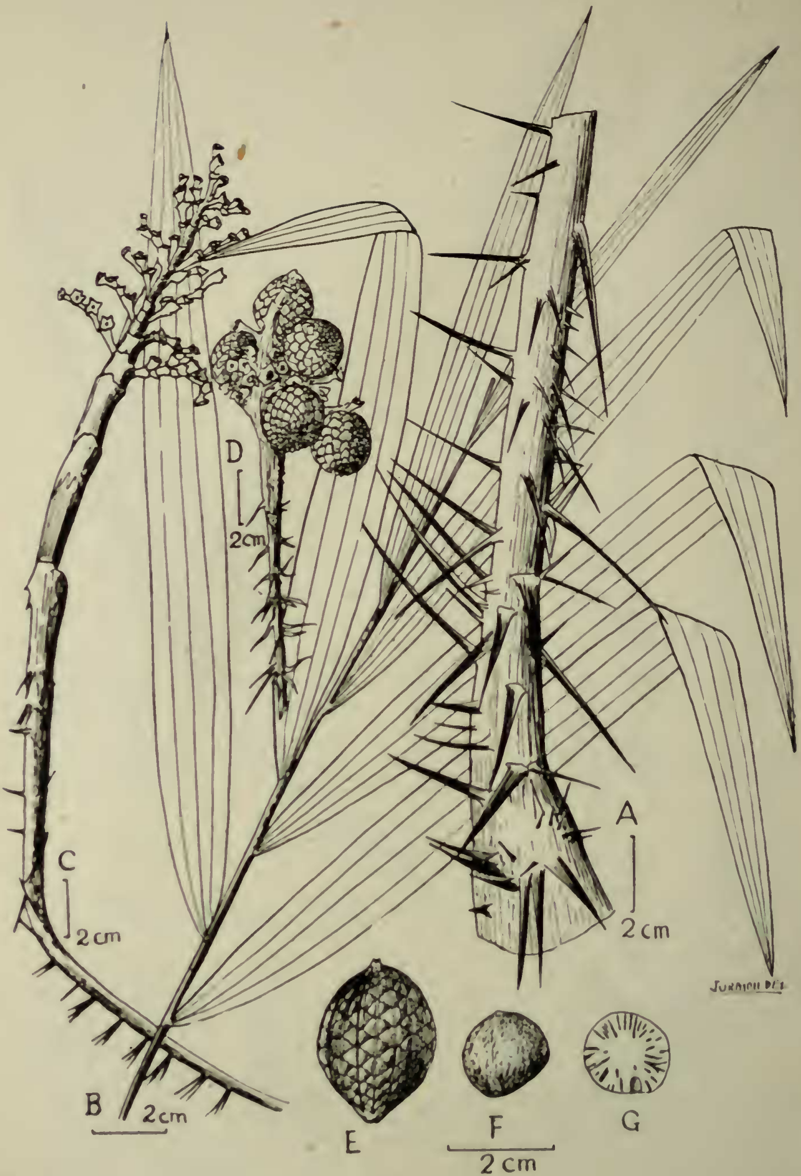
D. propinquus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 467 quoad specimina perakensia dubie citata; Ridl., Mat. Fl. Mal. Pen. II (1907) 181 et Fl. Mal. Pen. V (1925) 41 p.p.

Stem soboliferous, acaulescent or up to 1 m. high, erect, with sheaths 3·5–5 cm. in diam. *Leaf-sheaths* short, coriaceous, thickly covered with ferrugineous deciduous furfur, and armed with unequal, schistose, or yellowish, solitary or united at base, deciduously furfuraceous spines, the larger spines up to 6 cm. long, laminar somewhat sinuous in margins, strongly narrowed towards the apex, the smallest ones 1 cm. long or even shorter, almost criniform; ocrea small, triangular at the base of the petiole. *Leaves* large with no or small rudimentary cirrus at the end; petiole about 1 m. long, bifacial, in the lower surface covered deciduously with ferrugineous furfur and armed with unequal



Daemonorops brachystachys (Furtado 33,057).

A, Pars petioli. B, Pars frondis cum foliolis. C, Spadix. D, Flos masculus. E, Flos apertus ut stamina appareant.



Daemonorops brachystachys (Nur 12,076).

A, Pars frondis basalis. B, Fragmentum frondis apicale. C, Spadix. D, Spadix cum fructibus. E, Fructus. F, Semen. G, Semen verticaliter discissum.

up to 1–15 cm. long spines, the larger spines along the margins and dorsum of the base, the smaller ones towards the distal half; the upper surface of the petiole somewhat concave or flat, armed in some cases with very small, rigid, pungent erect spines or tubercles seated towards the margins; rachis 2–2·5 m. long, armed with 1–3-nate claws, occasionally the claws in the basal half small or obscure. *Leaflets* numerous, subequidistant, lanceolate or lanceolate-ensiform towards the basal half of the rachis, others elliptic-lanceolate, broadest in the middle or near it, broader and abruptly constricted in the lower half at the base, gradually but arcuately narrowed towards the apex into an oblique acuminate bristly point with the upper half of the blade produced much beyond the apices of the midcosta and the lower half of the blade, setose above in the terminal portions of the midcosta and at times also of the two subprimary nerves and below in the terminal portion of the midcosta, spinulous in the margins, glabrous in other parts, longitudinally plicatulate; subprimary costae very slender; transverse nerves invisible; the largest leaflets 40–60 cm. long, 4·5–6 cm. broad, the smaller ones towards the apex, and the rudimentary ones in the small cirrus. *Female spadix:* peduncle about 25 cm. long in one spadix seen, 1 cm. broad, 0·5 cm. thick, reflexed, ancipitous on axial side, flattened and, excepting a small unarmed portion, armed on the surface and as also on the margins with solitary, digitate or seriate spines up to 2 cm. long, in the distal side somewhat convex, glabrous or armed with a few short or obscure spines towards the apex; the axis about 15 cm. long in one fruiting spadix and 6 cm. in the other, in each the lower half being infertile; primary spathes not seen; primary branches 2, about 3–4 cm. long, each bearing 3–4 spikelets on each side; secondary spathes short annular with a prolonged apex on one side; spikelets 2–3 cm. long, bearing 2–4 fruits on each side; spathels short annular with a prolonged apex on one side. *Involucrophore* slightly longer than the spathel; involucre obconical, slightly exsert on one side, shallow at apex, asymmetric, with practically no lamina on one side of the disc; areola broad, niche-like with acute margins and almost disc-like scar. *Fruiting perianth* explanate. *Fruit* oblong-elliptic, narrowed on both sides excluding the small, 2 mm. long mucro about 23–15 mm. long, 16–20 mm. in diam.; scales channelled in the middle, of a uniform reddish brown colour, arranged in 18–21 vertical series usually covered profusely with dark red resin. *Seed* ovoid, obscurely angular, sometimes compressed on one side, 12–15 mm. long, 12–15 mm. broad, 12 mm. thick. *Male spadix* about a metre long, erect and cylindrical before flowering, covered externally with deciduous ferrugineous furfur; peduncle 5–12 cm. long, furfuraceous, biconvex armed more or less along the two margins with a few short spines, or unarmed; primary spathes woody or coriaceous, imbricately enclosing the unopened inflorescence, cylindrical or slightly broader towards apex, obliquely truncate, acute or bifid at apex, later longitudinally opened, strapshaped, and often revolute; the basal spathe persistent or later deciduous, bicarinate, armed along the ridges and along the margins with solitary, digitate or subseriate spines; the second spathe glabrous or occasionally armed with a few spines; other primary spathes unarmed; primary branches about 12–14, alternate, porrect, cupressiform, the longest ones seated towards the base and 8–12 cm. long, those at the apex shortest about 3–4 cm. long, all producing spikelets or spikelet-bearing branchlets, the axis in all divisions being angular and deciduously furfuraceous; the secondary and the tertiary spathes, short, annular, obliquely truncate, ligulate, rarely developed into a large broad, ear-shaped structure; spathes very short, annulate, ligulate on one side. *Involucre* small, disciform. *Male flowers* asymmetric, somewhat sinuous, 4–5 mm. long; calyx very short, cyathiform, arcuately 3-apiculate; corolla 4–5 times as long as the calyx, striate.

MALAYA: *Kelantan,* Sungai Keteh at Batu Papan (Nur with Foxworthy 12,076, Holotype, vern. name *Atap Chuchur*). *Kedah,* Sungai Labong at Baling (Furtado 33,057). *Perak,* Upper Perak (Wray 3,658). *Selangor,* Seminyih (Hume 8,113).

Since the fruits are congested on the spadices, the shape of the fruit will depend on the space available for its growth. *Furtado 33,057* which was collected from a tufted plant is a male specimen and much more robust than all the others seen. Its leaflets have only the midnerves setose in the upper side, with no setae in each of the subprimary nerves on either side of the midrib; whereas in all other specimens the setae are in the three nerves above. The description of the male spadix has been drawn mainly from this Kedah specimen, as are also the details about the petiole. The differences so far noticed in the Kedah specimens did not justify their separation into a separate variety or species.

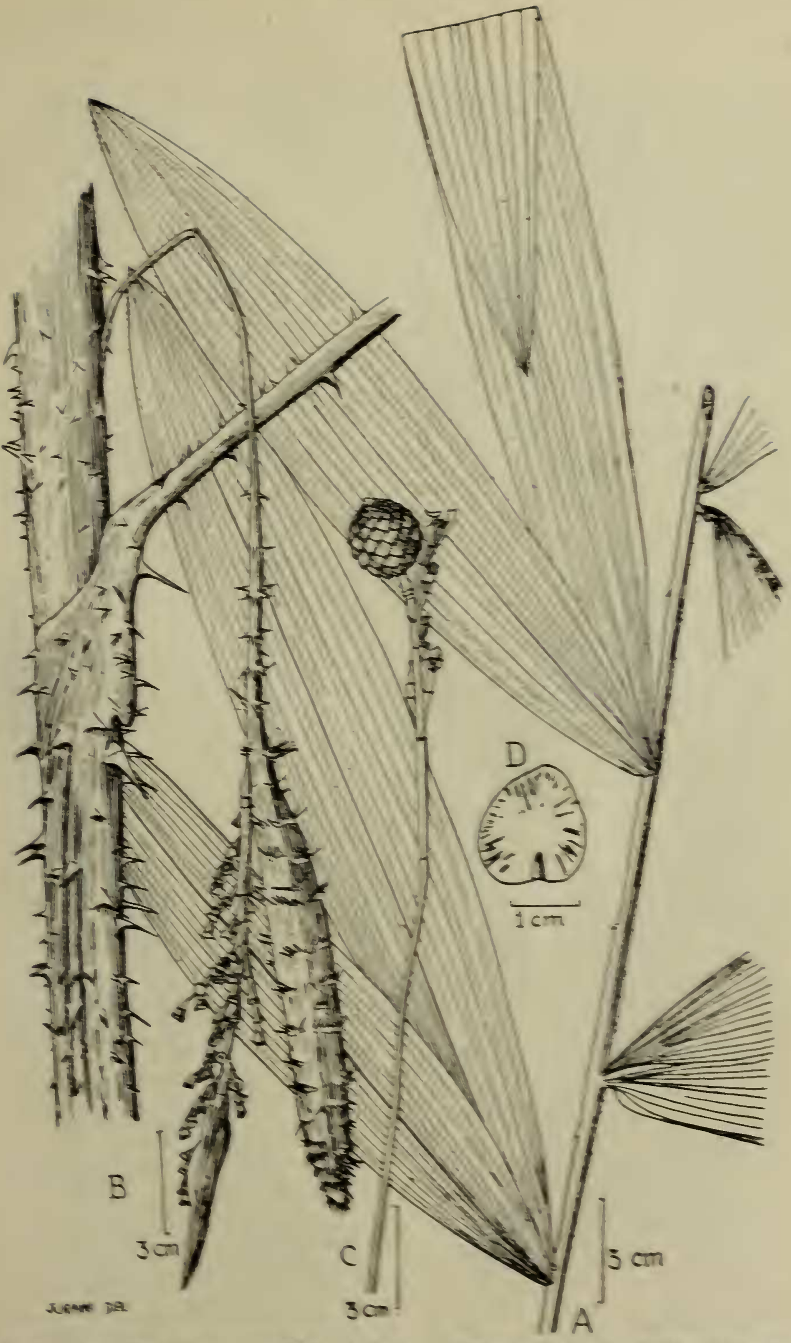
The only other species having a short stem is *D. gracilipes* which has thinner stems, less armed sheaths, more or less grouped and ensiform leaflets, and less series in the fruit scales.

Daemonorops didymophyllus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 468; Ridl., Mat. Fl. Mal. Pen. II (1907) 180; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 123; Ridl., Flor. Mal. Pen. V (1925) 41; Furtado in Gard. Bull. Straits Settl. VIII (1935) 349.

D. cochleatus Teijsm. et. Binn. in Cat. Plant. Hort. Bogor. Suppl. (1866) 381 nomen; Becc. in Malesia II (18) 77, 276–277 nomen.

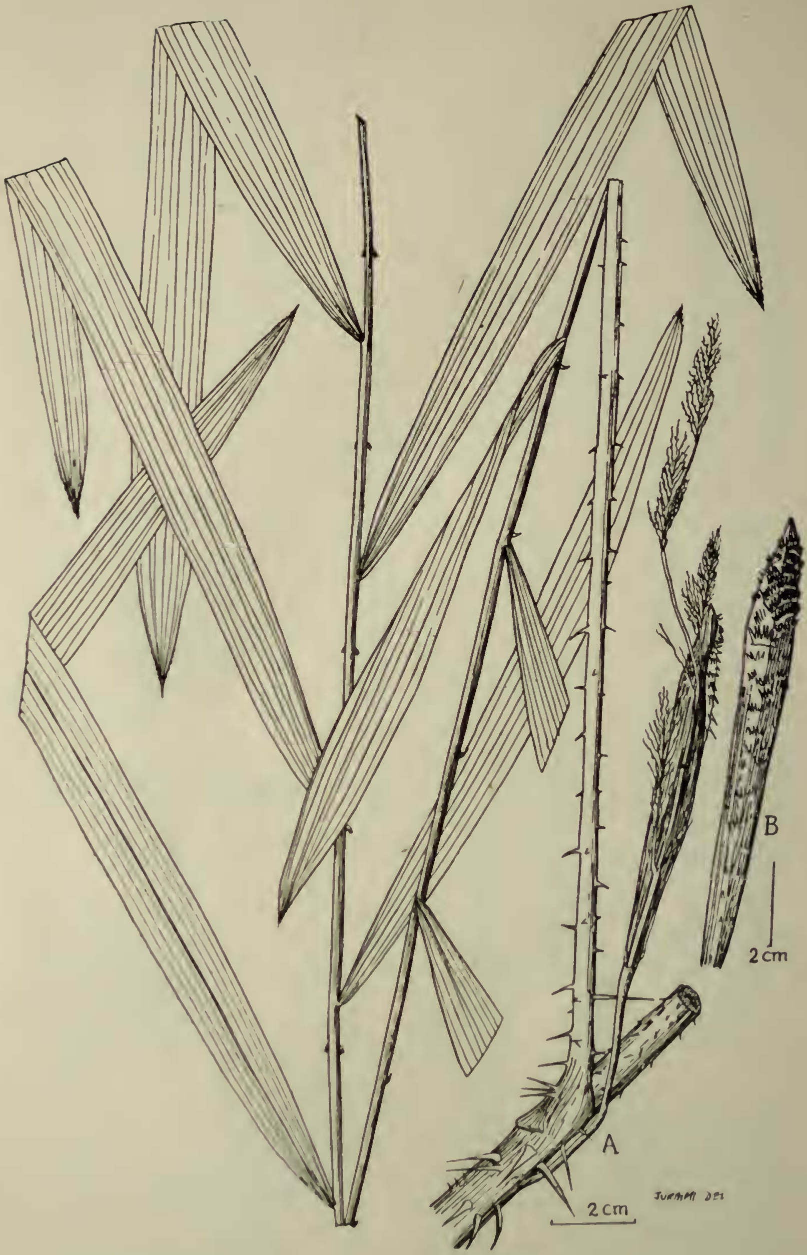
Calamus cochleatus Miq., de Palm. Arch. Ind. (1868) 29 nomen.

Stem tufted, scandent, fruiting early, 10–20 m. long, with sheaths 2–3·5 cm. through. *Leaf-sheaths* obliquely truncate, usually with no spines at the mouth, gibbose below the petiole, sulcate or broadly striate, covered with deciduous brownish furfur, armed irregularly with unequal, scattered, solitary or subseriate, laminar, broad-based, concave beneath, reflexed spines, the largest of these being about 10–20 mm. long, nearly twice as long and much less in the younger specimens. *Leaves* 2–3 m. long excluding 60–100 cm. long cirrus; petiole 20–75 cm. long, shorter in the upper leaves, biconvex, sprinkled above with short, erect prickles; armed along the margins with longer spines, and



Daemonorops didymophylla (*A–B.: Corner 30,271; C–D: Corner 30,491*).

A. Pars frondis ut foliola appareant. B, Pars caudicis cum parte petioli basali et spadice. C, Spadix fructiferus. D, Semen verticaliter discissum.



Daemonorops didymophyllus (Furtado 33,027).

A, Caudicis fragmentum cum fronde et spadice masculo. B, Spatha externalis.

below along the dorsal median with solitary claws and with scattered prickles at the base; rachis armed with short, scattered prickles above, and with 1–3–5-nate claws beneath. *Leaflets* not very numerous, solitary or in pairs, about 15–20 cm. apart on each side, with the bases in the pairs almost touching each other, elliptic-lanceolate or elliptic-ensiform, gradually alternate towards the base, arcuately or abruptly ending in a triangular, sometimes shortly caudate apex, green, longitudinally plicate and striate with many slender, sub-primary nerves, unarmed on both surfaces, minutely and appressedly spinulous in the margins; the largest leaflets 25–35 cm. long, 3–5 cm. wide, the basal ones narrowest and the apical ones also the shortest. *Female spadix* recurved; peduncle 2–15 cm. long, biconvex, slightly flattened on the adaxial side, usually more or less armed in the upper half with short, solitary or digitate spines along the margins, and often with digitate or subseriate spines on one or both sides, sometimes entirely unarmed; the fertile portion 10–15 cm. long, sometimes longer, oblong-ellipsoid before flowering, very slightly longer than the outermost spathe; primary spathes imbricate, concave-cymbiform, ending with a broad triangular apex; the outermost spathe more or less thickly armed with digitate or subseriate spines; the second one slightly armed with digitate spines near the apex only; others usually unarmed; main axis thickly covered with furfuraceous indumentum as also the other parts; primary branches 3–6, the lower ones bearing 5–6 spikelets; the largest spikelets about 3–4 cm. long with 5–6 flowers in all; spathels shortly annular with extended limb on one side. *Involucrophore* short, thick, obconical, slightly angular, extended into a triangular limb on one side, involucre slightly exsert, restricted on one side to a slender margin round the disc and developed on the other side into a long limb; areola niche-like, with small, unswollen scar. *Female flowers* 6 mm. long; calyx cupular-obconical, with a truncate base, divided arcuately at apex into 3 superficial lobes, finely striate; corolla slightly more than double the length of calyx, striate, conical before opening. *Fruiting perianth* quite explanate. *Fruit* broadly ovoid, narrowing into a conical, mucronulate tip, 17–23 mm. long, 15–18 mm. broad; scales arranged in 12–15 vertical series, occasionally in 16, channelled in the centre, yellowish brown in colour, more or less tinged blood red with a thin resinous coating, margins appearing darker because of the thicker resinous accumulation. *Seed* 10–13 mm. long, ovoid to globular, minutely pitted; albumen ruminate; embryo basal. *Male spadix* cylindraceous, much longer than the female, 25–45 cm. long, excluding short, slender, two-edged, slightly armed at apex or entirely unarmed, 2–10 cm. long peduncle; the spathes blunt or bidentate, usually less armed than those in the female, much protruding from the enclosing lower one; the 2nd and 3rd, sometimes also the 4th and even the 5th spathes armed with a few spines; primary branches cupressiform, appressed, covered all over with rusty furfur; spikelets 1–2 cm. long with 4–7 flowers on each side; spathels small, bracteiform, acute. *Involucre* as long as the spathels, often with two acute opposite lobes. *Male flower* 4 mm. long, with a corolla three times as long as the calyx.

MALAYA: *Kemaman,* Ulu Bendong, alt. 150 m. (Corner 30,174 and 30,494). *Kelantan,* Sungai Keteh at Batu Panjang (Nur 12,113). *Perak,* Kroh (Furtado 33,027 and 33,028); Jor (Haniff 14,231 as *Gum Chebor* in Sakai); Tapah (Burkill and Haniff 13,450); Maxwell Hill, alt. 1,000 m. (Burkill and Haniff 12,681); Taiping Hills (Ridley in February 1904). *Penang,* Penang Hill

(Ridley 10,345). *Selangor,* Rawang (Ridley 7,885 as *Rotan Tahi Ayam*); Bukit Enggong at Kajang (Symington 24,207 as *Rotan Kembong*). *Pahang,* Tembeling (Henderson 24,532). *Johore,* Tañjong Kopang (Ridley 6,285); Mount Austin (Ridley in June 1904); Pulau Tinggi (Burkill 928 as *Rotan Tawa*); Sungai Pelepah (Nur 20,045); Gunong Rawang (Ridley in Nov. 1900). *Singapore,* Mandai (Ridley 10,437 in 1907 and on 22nd May, 1900; Holttum on 24th July, 1940); Changi (Ridley 6,273 and s.n. 1894); Chan Chu Kang (Ridley 3,476 as *Rotan Udang* and s.n. in 1892); Selitar (Ridley 6,277 and s.n. on 2nd April, 1894 and 9th December, 1890, and in 1892 as *Rotan Udang*); Garden jungle (Ridley 9,851); Bukit Timah (Ridley 5,875 and 6,672; s.n. in 1893; in February 1900; August 1892, and in 1895 as *Rotan Getah*).

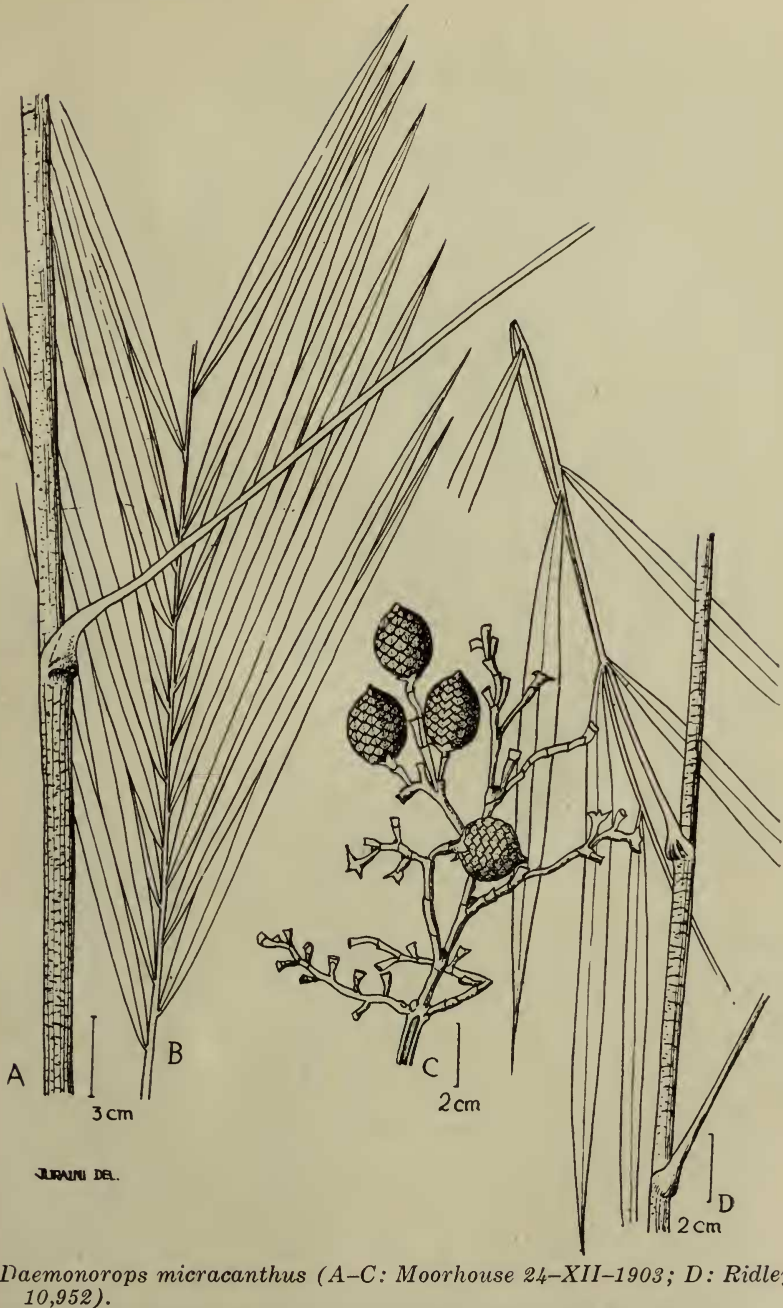
Daemonorops micracanthus (Griff.) Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 467 et in Ann. Roy. Bot. Gard. Calc. (1911) 110 pl. 43; Ridl., Mat. Fl. Mal. Pen. II (1907) 180 et Fl. Mal. Pen. V (1925) 41 p.p.; Furtado in Gard. Bull. Straits Settl. VIII (1935) 356.

D. draconcellus Becc., Nelle For. di Borneo (1902) 324, 590 et 608, et in Ann. cit. XII (1911) 108 pl. 42; Merr., Bibl. Enum. Born. Pl. (1921) 78.

D. propinquus Becc. *sensu* Ridl., Mat. cit. II (1907) 181 et Fl. cit. V (1925) 41 p.p.

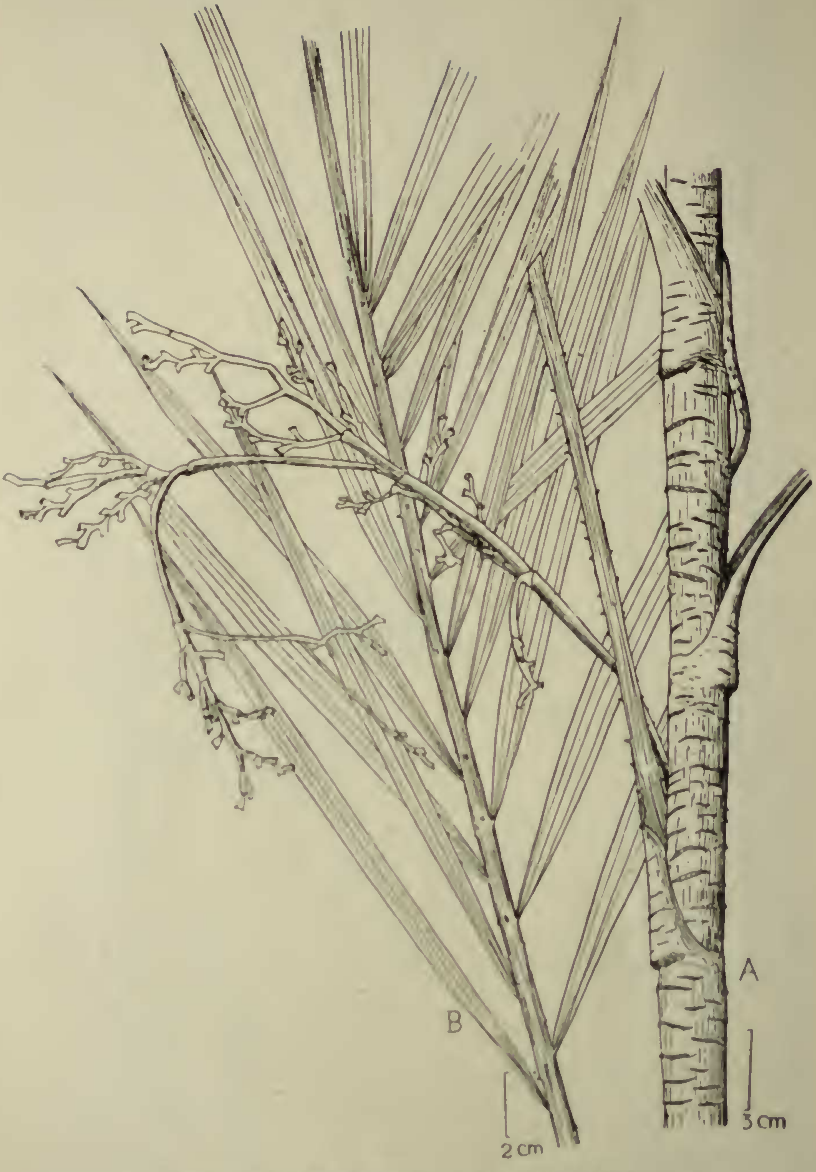
Calamus micracanthus Griff. in Calc. Journ. Nat. Hist. V (1844) 62 et Palms Brit. Ind. (1850) 72; Mart., Hist. Nat. Palm. III (1849) 339.

Stem scandent, 10–15 m. long, with sheaths 2–2·5 cm. in diam., young ones very much slender. *Leaf-sheaths* very short, 10–15 cm. long, gibbous above, transversely rugose; rugae short, irregular, interrupted, later reflexed, formed by the union, at base, of acicular, criniform or subsetiform, 4–15 mm. long, shining black or dull straw-coloured, black pointed spiculae; in young specimens leaf-sheaths very much longer, covered with minute, scattered or confluent or subseriate, spiculiferous tubercles, or superficial ridges; ocrea short. *Leaves* 1–1·5 m. long excluding about 60 cm. long cirrus; petiole 25–40 cm. long, biconvex, above obscurely ridged along the upper median, and unarmed except along the margins, almost flat or slightly concave at the very base, on the dorsal side armed with the spiculiferous warts or ridges in the basal portion above the gibbosity, with short spines along the margins, and with remote solitary claws or unarmed along the centre; rachis armed above in the basal half or along with short rigid prickles, and below with 1–5-nate claws. *Leaflets* numerous, equidistant, about 2–2·25 cm. apart, porrect, alternate to sub-opposite, 30–35 cm. long, 10–13 mm. broad, linear-lanceolate, gradually narrowed on both ways from the middle, ending upwards into a long acuminate, bristly tip; midnerve setose on both surfaces in the terminal half of the leaf; one sub-primary nerve on each side remotely bristly on both surfaces. *Female spadix* 25–40 cm. long; peduncle 4–8 cm. long, bifaced, armed along the margins with short spines; primary spathes deciduous, not seen; primary branches 3–5, porrect, covered all over with ferrugineous deciduous tomentum, the



Daemonorops micracanthus (A–C: Moorhouse 24–XII–1903; D: Ridley 10,952).

A, Fragmentum ut caudex juvenilis magis evolutum appareant. B, Pars frondis ejusdem caudicis. C, Spica cum fructibus juvenilibus. D, Fragmentum ut caudex juvenilis et frons cum foliolis minus evoluti appareant.



Daemonorops micracanthus (Moorhouse leg. in 1908).

A, Caudicis fragmentum adulti cum frondis petiolis et spadice. B, Frondis pars cum foliolis.

lowermost the largest measuring 8–12 cm. long, bearing 3–4 spikelets on each side, other branches gradually shorter and with less spikelets; secondary spathes shortly annular; spikelets 3–5 cm. long, spreading when in fruit, angular in axis, each bearing 3–5 flowers on each side, shorter spikelets found in the uppermost branches; spathels shorter, annular, acute on one side. *Involucrophore* pedicelliform, angular, 4–6 mm. long, usually much above the spathel, in fruit much callused in the axil, spreading, truncate above with triangular apex on one side; involucre more or less raised above the involucrophore, shortly pedicelliform, flat-discoid at apex, edged by a short limb; areola niche-like, sharply edged. *Fruiting perianth* shortly pedicellate at base; corolla about twice as long as the calyx. *Fruit* ovoid-ellipsoid beaked, 22–25 mm. long, 18–20 mm. in diameter; scales arranged in 18–21 series, uniform yellowish brown in colour, channelled in the middle, covered with incrustations of abundant, blood-red, resinous secretion. *Seed* when divested of the dry crustaceous brittle integument 12–13 mm. long, 11 mm. broad, 7–8 mm. thick, ovate oblong, somewhat flattened on one side, ventricose on the other, pitted on the surface, with the chalazal fovea punctiform in the centre of the side with a fine channel below, somewhat truncate at base; albumen ruminate; embryo basal. *Male spadix* 45–50 cm. long; primary spathes fallen in both the specimens seen; primary branches 5–6, strict, cupressiform, 10 cm. long, shorter in the upper parts; spikelets representing secondary branching 2–5 cm. long with 3–6 flowers on each side, and those representing tertiary and quaternary branching 1–2 cm. long, few flowered; spathels small, bracteiform. *Involucre* minute, orbicular. *Male flower* only one seen, 3 mm. long, oblong, asymmetric; calyx shallowly cupular at base, arcuately 3-toothed, finely striate; corolla about 2½ times as long as the calyx, finely striate.

MALAYA: *Kemaman*, loc. incert. (Vaughan-Stevens in 1890, as *Rotan Jernang*); Bukit Kajang (Corner 30,340 as *Rotan Ulat*). *Negri Sembilan*, Bukit Senaling (Moorhouse as *Rotan Jernang* on 24th December, 1903); Kuala Pilah (Moorhouse in 1903; 1904 as *Rotan Jernang*). *Johore*, Panchur (Ridley 10,952 as *Rotan Tai Ayam*). *Singapore*, Bukit Timah (Ridley in 1900).

DISTRIBUTION: Borneo.

In the description given here I have not used any data given by Beccari either under *D. draconcellus* or *D. micracanthus*. Beccari had not seen any mature specimens from Malaya; and *D. draconcellus* is based on a 'specimen' representing two or three or perhaps even four collections. The fruits are of two kinds representing two collections; and neither of these, nor the female spadix in flowers could be of the same collection as the male spadix with leaf-sheaths. It is even possible that the portion of the leaf bearing leaflets may be of another leaf. However my identification of *D. draconcellus* is based entirely on the male specimen and the leaflets. This species is described by Beccari as having its main ribs smooth above. Otherwise the specimen does not seem to merit a specific separation from *D. micracanthus*. The leaf-sheaths depicted in the plate represent the stage when the spiculae are yet on; later these fall off and their vestiges produce minute, reflexed wrinkles.

In the male specimens the petiole and the rachis seem to be more armed than those in the female. The plant is known as *Rotan Jernang* because it produces Dragon's Blood, probably the best of its kind. It is called *Rotan Tai Ayam* because the stems, principally the young stems, are rough and appear variegated and *Rotan Ulat* because the acicular spiculae sting like the hairs of bamboo sheaths.

Two specimens which were formerly cited by Ridley (1907 and 1925) under *D. propinquus* were referred doubtfully by me (1935) under this species, but after a comparative examination I find that they belong to *D. Kunstleri.* The leaf in Ridley 10,783 (Bukit Timah) belongs to *D. hystrix.*

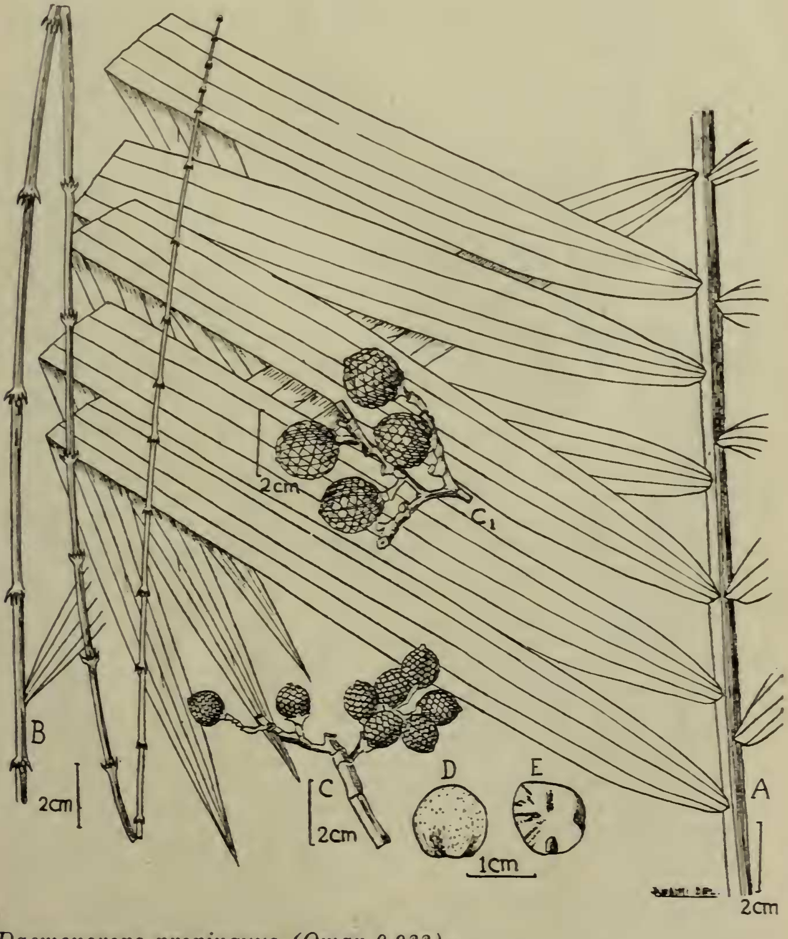
Daemonorops propinquus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 467 p.p. et in Rec. Bot. Surv. Ind. II (1902) 224; Ridl., Mat. Fl. Mal. Pen. II (1907) 181 p.p.; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 11 p.p. t. 44; Ridl., Fl. Mal. Pen. V (1925) 41 p.p.; Furtado in Gard. Bull. Straits Settl. VIII (1935) 358.

D. draco Bl. *sensu* Mart., Hist. Nat. Palm. III 2nd Ed. (1849) 205 p.p. t. 175 fig. 3–7.

Calamus draco Willd. *sensu* Griff. in Calc. Journ. Nat. Hist. V (1844) 65 et Palms Brit. Ind. (1850) 75 tt. 201 A and B.

Stem scandent, short (?). *Leaf-sheaths* not seen. *Leaves* apparently large, terminating in a 75–100 cm. long cirrus; rachis armed below along the dorsum with 1–3–5-nate claws, unarmed above. *Leaflets* numerous, alternate or sub-opposite equidistant, 3·5–6 cm. apart, lanceolate-ensiform, ending gradually into a subulate tip; the largest in the lower half of the leaf, 30–40 cm. long, 2·5–3 cm. broad, distinctly bicolorous; in the terminal part of the leaf smaller, narrower, inequidistant, concolorous; bristly above in the median and the two sub-primary nerves, and beneath only in the median, setulose in margins. *Female spadix* nodding, cylindrical before opening, 40–50 cm. long; peduncle about 10 cm. long armed with strong, digitate spines; primary spathes coriaceous or woody, deciduous after flowering; the outermost spathe armed all over with digitate spines; two or more subsequent spathes armed with a few digitate spines arranged in a line on the dorsum; primary branches 5–7, the longer ones 12–16 cm. in length with 3–5 spikelets on each side, upper branches shorter; spikelets 4 cm. long, angular in axis, with 5–9 subsecund flowers; spathels short, annular, with an acute limb on one side. *Involucrophore* pedicelliform, thick obconical, angular, truncate and flat above, with a triangular limb on one side; involucre slightly exsert and pedicelliform, orbicular discoid at apex, edged by a short limb produced on one side; areola niche-like, sharply edged. *Fruiting perianth* explanate. *Fruit* 22–25 mm. long, 18–20 mm. in diam., ovoid, gradually narrowed towards the apex, crowned with the vestiges of stigma; scales arranged in 16–18 vertical series, grooved along the centre, uniformly yellowish brown, covered abundantly with dragon's blood secretion. *Seed* ovoid, with flattish base, 12–15 mm. long, 10–13 mm. broad, slightly ventricose on raphal side, with pitted surface; albumen ruminate; embryo basal. *Male spadix* not seen.

MALAYA: *Perak*, loc. incert. (Scortechini, lectotype). *Selangor*, Ayer Kuning (Omar 9,933 as *Rotan Jernang*). Sungai Buloh (Omar 9,916 as *Rotan Jernang* in Herb. Kepong). *Pahang*, Plangai (Burkill and Haniff 16,792 as *Rotan Jernang*). *Malacca* ? (Griffith 83, excluding fruits in Herb. Kew).



Daemonorops propinquus (Omar 9,933).

A, Frondis fragmentum medianum. B, Cirrus frondis. C–C¹: Spicae fragmenta. D, Semen. E, Semen verticaliter discissum.

The leaflets of this species resemble very much those of the lower leaves of *D. brachystachys*, but the latter is a short stemmed species and has similar fruit scales which are dark-brown and arranged in 18–21 vertical series.

Griffith's collection may have come from Malacca and the fruit scales mounted with it do not belong to it. (cf. Furtado op. cit. p. 360). Martius mentions both Lewes and Griffith as having collected the specimens seen by him and does not mention fruit scales fewer than in 15 series. I did not see Scortechini's specimen and so I have used Beccari's plate in identifying the species.

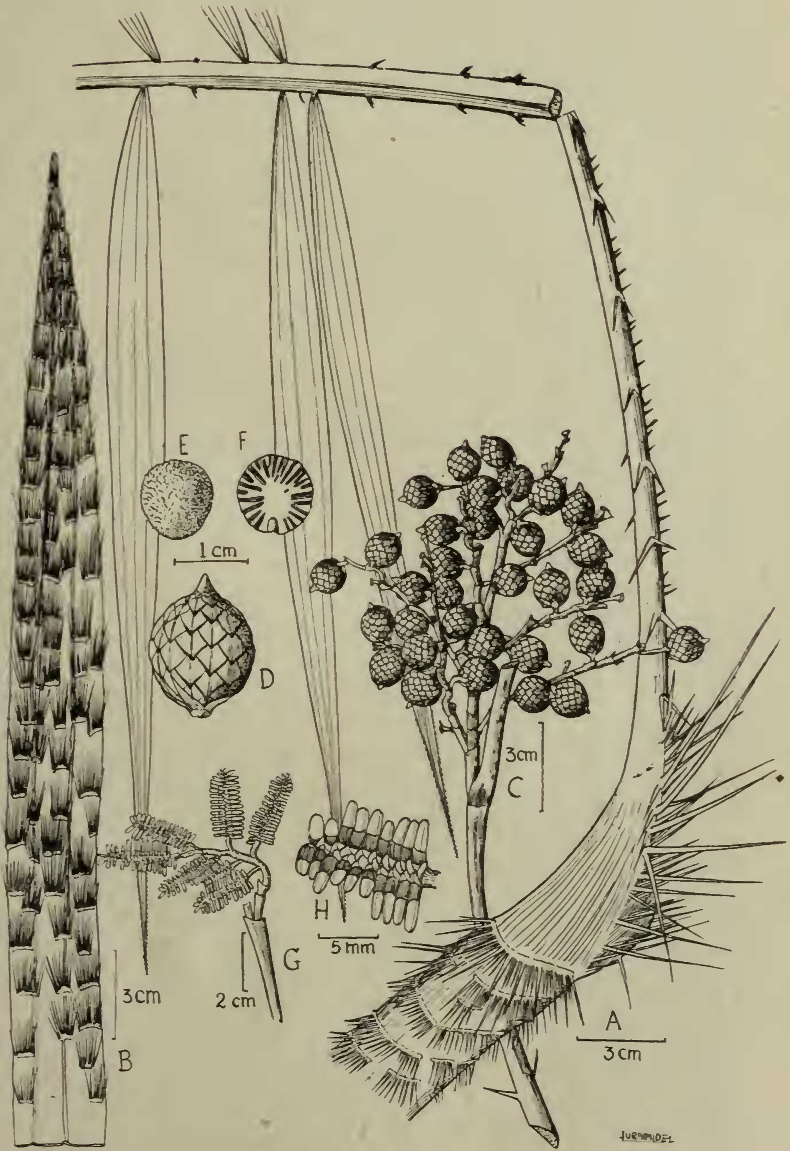
This appears to be one of the best species that yields Dragon's Blood.

Daemonorops geniculatus (Griff.) Mart., Hist. Nat. Palm. III (1950) 329; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 470; Ridl., Mat. Fl. Mal. Pen. II (1907) 184; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 186 tt. 81 & 82; Ridl. Fl. Mal. Pen. V (1925) 44; Furtado in Gard. Bull. Straits Settl. VIII (1935) 363 sub *D. setigerus*.

D. setigerus Ridl., Flor. cit. V (1925) 45 partim.

Calamus geniculatus Griff. in Calc. Journ. Nat. Hist. V (1845) 67 and Palms Brit. Ind. (1850) 77 pl. 202 A & B.

Stem solitary or tufted, 8 m. long or more, 3–5 cm. in diam. with sheaths. *Leaf-sheaths* not or obscurely gibbous above, armed with several, subparallel, oblique, incomplete or sometimes complete rows of deflexed or spreading spines united at their bases into membranous rings; spines unequal, 2–4 cm. long, thinly laminar and blackish, in addition to slender, brittle needle-like spiculae intermingling; very obliquely truncate at the mouth, armed densely with long and narrow ascendent, up to 10–15 cm. long, schistaceous or paler spines. *Leaves* large, 2–3 m. long, excluding about 1 m. long cirrus; petiole 60–100 cm. long shorter in the leaves of the older stems, armed along the margins with unequal divergent, digitate spines, longer in the basal portions, practically unarmed in the median of the dorsum, but armed in the upper surface of the petiole with few minute prickles, more in the basal portion; rachis armed beneath with 3–7-nate, black-tipped claws. *Leaflets* numerous, often arranged in distinct, sub-opposite or alternate groups; groups about 3–15 cm. apart; leaflets in each group 5–7 in all, in one plane, 2–4 cm. apart, green above, paler beneath narrowly lanceolate or ensiform, with caudate bristly tip, smooth, or remotely spinulous in the midnerve above, in the lower surface smooth, or very shortly bristly in 1–5-nerves, remotely and minutely spinulous in the margins; transverse veins inconspicuous. *Female spadix* erect, elongate, cylindrical before flowering, decompound, panicle 60–100 cm. long, divided into 5–7 spikelet-bearing, primary branches; peduncle 30–60 cm. long, flattened, unarmed, or armed along the



Daemonorops geniculatus (Kiah 35,223).

A, Petiolus. B, Spatha externalis. C, Spadix fructiferus. D, Fructus. E, Semen verticaliter discissum. G, Spicula spadicis masculi. H, Spicula.

edges with short, simple or digitate spines; primary spathes thin, exsuccous, deciduously furfuraceous when young; outermost spathe covered with several narrow, subspiny, weak, black or brown bristles often arranged in short horizontal crests; other primary spathes shorter, armed only in terminal portions exposed before the anthesis; axial parts densely furfuraceous when young, glabrescent later, unarmed; primary branches erecto-patent, 12–20 cm. long, with 3–6 bifarious spikelets on each side; secondary spathes bracteiform with a triangular, acuminate point on one side; spikelets 8–12 cm. long, curvedly sinuous in axis, with 4–7 distichous flowers on each side; spathels loosely funnel-shaped, with a triangular apex. *Involucrophore* callused in the axilla, pedicelliform specially in the lower parts of the spikelets, sessile, though exsert in the terminal parts, cupular at apex, narrowed towards the base; involucre oblique, cupular slightly exsert on one side; areola distinct, ovate niche-like, with uncallused scar. *Female flowers* 6–7 mm. long, ovate; calyx striate, 3-fid, nearly half as long as the corolla. *Fruiting perianth* almost explanate with a slightly callused calyx-base. *Fruit* globular-elliptic about 20 mm. excluding perianth and 2–3 mm. long mucro, 15–18 mm. broad; scales in 15 longitudinal series, when young straw-coloured with dark brown, intra-marginal line, and fine, white erose margins, later minute splashed reddish in the body. *Seed* obscurely trigonal or globose ventricose on one side; 15 mm. long, 15 mm. broad, 13–14 mm. thick, ruminate; embryo basal. *Male spadix* like the female but spura-decompound; male flowers arranged pectinately on the spikelets produced on secondary branches.

MALAYA: *Trengganu*, Ulu Brang Tersat, ± 1,000 m. (Kiah and Moysey, 33,392). *Kemaman*, Bukit Kajang (Corner 30,463 and 30,466); Ulu Bendol at Kajang (Corner 30,074 and 30,078). *Kelantan*, Sungei Keteh (Nur 11,927 as *Rotan Dudoh*); Gua Musang (Henderson 22,712); Sungai Chalil (Henderson 29,544). *Kedah*, Koh Mai (Kiah 35,223); Kedah Peak (Ridley in June 1893); Weng (Furtado 33,066). *Perak*, Kroh (Furtado 33,030 and 33,009 as *Rotan Lilin*); Larut Hills by Mengharan River (Anderson 166 partim, male and female); Taiping Hills (Ridley 11,409); B.P. district (King's Collector 7,849); Larut, alt. 600–1,200 m. (King's Collector 2,735); Maxwell Hill (Burkill and Haniff, 12,788); Dindings (Ridley 7,901 as *Rotan Dudok*); Bujong Malacca (Ridley 9,811 and 9,813); Bukit Kapayang by Sungai Siput (Ridley in 1907); Assam Kumbang (Wray 1,922). *Pahang*, Kuala Lipis (Machado 11,635); Gunong Senyum (Henderson 22,306); Rabu (Furtado 33,104); Tembeling (Henderson 24,804 and 21,907); Bukit Chemaga (Henderson, 19,482); Sungai Telom (Kiah 24,006); Chegar Perah (Henderson 19,391); Gunong Sempang (Burn-Murdoch 13,300); Tahan River (Mat. 21–IX–39); Fraser Hill by Sungai Yet (Nur 11,131). *Penang*, Highland Hill (Haniff 9,145); Bukit Laksamana (Curtis 1,746); Government Hill (Curtis 712 and 2,222). Batu Feringgi (Fox's Collector, vern. name as *Rotan Landa*). *Province Wellesley*, Bukit Mertajam (Burkill 9,034). *Selangor*, Pahang Track (Ridley 8,778); Semangko (Ridley in August 1909); Ginting Simpak (Hume 9,463); Ginting Bidai (Ridley 7,892 as *Rotan Segerah*). *Negri Sembilan*, Gunong Tampin (Holttum 9,569). *Malacca*, Bukit Sedenan (Bebas 106, as *Rotan Jelutong;* Derry 959 as *Rotan Kerai;* Bebas 102, as *Rotan Perpah* and 111 as *Rotan Tungal*). *Johore*, Sungai Kayu Ara (Corner and Furtado 29,483); Batu Pahat (Lake and Kelsall in 1892). *Singapore*, cult. in Hort. Bot. Bogor. XII. C. 84 (Furtado 30,845*a*).

SUMATRA: Palembang cult. in Hort. Bot. Bogor. XII C. 87 (Furtado 30,845).

BORNEO: cult. in Hort. Bot. Bogor. XII. C. 123 (Furtado 30,807) cult. in Hort. Bot. Bogor. XII. C. 9 (Furtado 30,822).

In the field note of Corner 30,466 it is stated that the leaflets are not in groups; because of this and also because the crests on the leaf-sheaths are horizontal and not oblique, and the basal halves of the petioles are broadly channelled and armed with triangular, 1–2 cm. spines which are pointing obliquely towards the median, I was inclined to make this specimen, the type of a new species, even though in other respects no material differences are lacking in it to separate from *D. geniculatus.* But a careful comparison shows that Corner 30,466 represents a vigorous growing plant with a thick stem, and the leaf specimens, though long and with a long cirrus at the end, show no geniculus, even a faintly developed one—facts which show that the plant which supplied the specimens was young. Some fragments of the leaves showed a tendency to leaflet-grouping as in *D. geniculatus,* a tendency noticed also in terminal parts. In a young leaf of *D. geniculatus* the petiole was shallowly channelled and was armed as in Corner 30,466.

As to their size, shape, texture and armature the leaflets in Corner 30,466 are exactly as in *D. geniculatus;* the spadix and the young fruits seen are also similar. In view of this I have no hesitation to place the collection under *D. geniculatus,* though in the keys I had to make a special provision to include the specimens with equidistant leaflets and horizontal crests—a description, as far as the specimens examined by me, which applies only to some specimens in the above cited Corner's collection.

Daemonorops hystrix (Griff.) Mart., Hist. Nat. Palm. III 2nd ed. (1849) 205 et (1850) 328 pl. 176 f. IV 3–4; Miq., Fl. Ind. Bot. III (1855) 91; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 469 et in Rec. Bot. Surv. Ind. II (1902) 226; Ridl., Mat. Fl. Mal. Pen. II (1907) 183 p.p.; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 135 t. 55; Ridl., Fl. Mal. Pen. V (1925) 42.

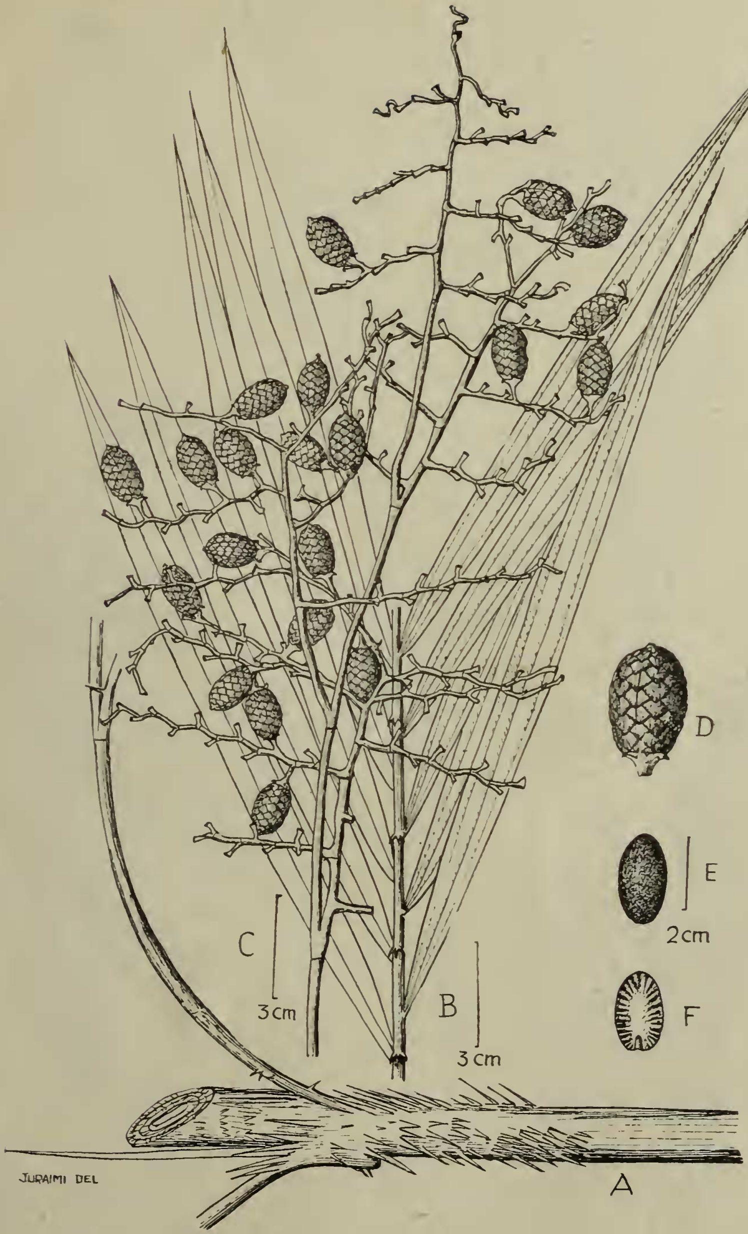
D. hirsutus Bl., Rumphia II (1836) p. 135 et II (1845) 21 quoad folia tantum.

D. hirsutus var. *brevifolia* Bl., Rumphia III (1845) 21.

Calamus hirsutus (Bl.) Miq., De Palm. Arch. Ind. (1868) 28.

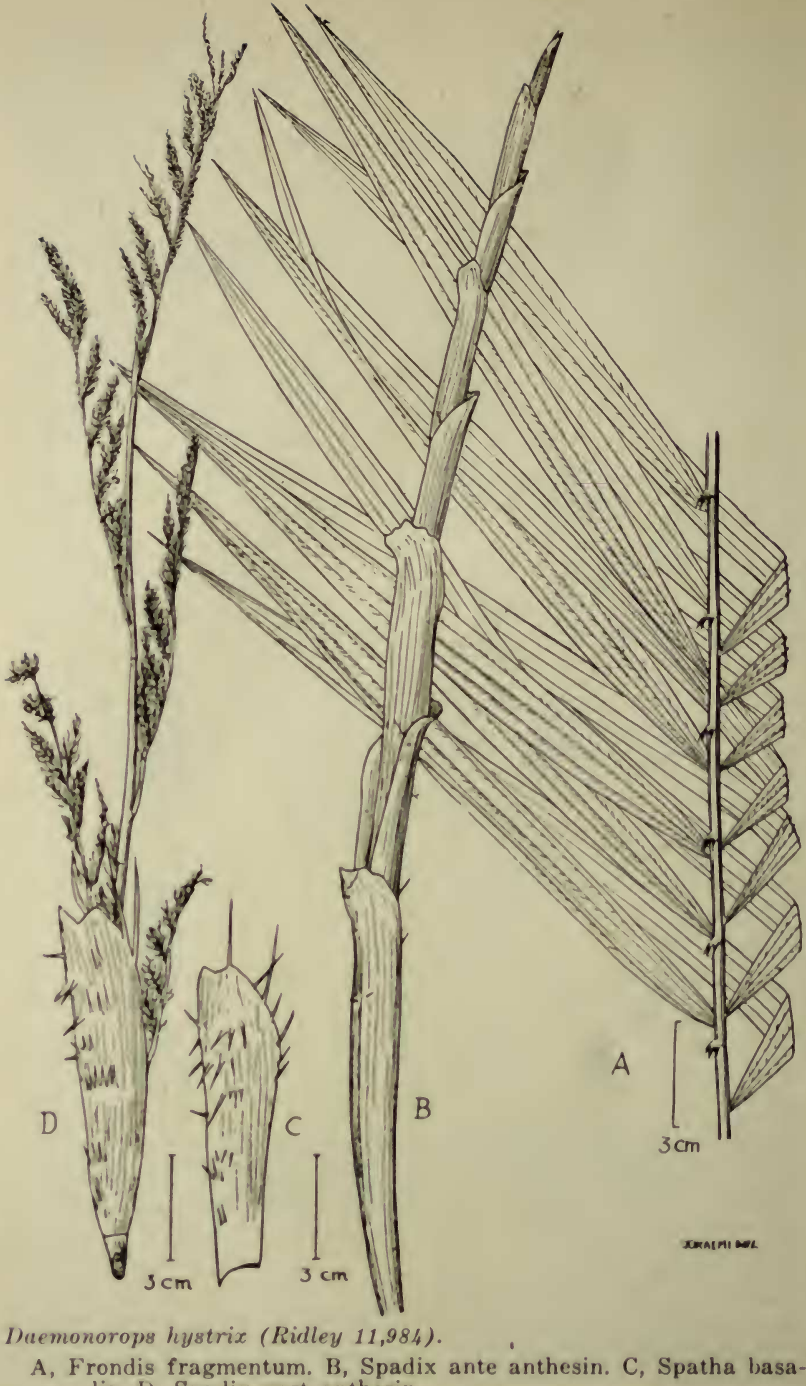
C. hystrix Griff. in Calc. Journ. Nat. Hist. V (1844) 71 et Palms Brit. Ind. (1850) 80 tt. 204 A, B & C.; Miq., De Palm cit. (1869) 28.

Stem scandent, very variable in size, tufted 2–4 cm. in diam. including sheaths. *Leaf-sheaths* gibbous armed conspicuously with several erect, flat, narrow laminar, light-coloured, straight or slightly sinuous spines; the spines on the sheaths usually 1–3 cm. long, solitary or seriate, sometimes confluent, horizontal or deflexed, and those at the mouth longer 3–8 cm. long, sometimes 20–30 cm. long, erect or oblique; ocrea very short. *Leaves* 1–2 m. long excluding 50–100 cm. long cirrus; petiole 30–45 cm. long, biconvex, slightly flattened at the base above, armed along the edges with 1–2 cm. (or longer at base), spreading spines, mingled with minute ascendent spines on the upper part of margins, usually smooth along the dorsum except for a few spines at the base and occasionally at apex; rachis in the upper surface of the basal portion remotely spinulous, along the dorsum 1–3–5-clawed. *Leaflets* numerous, equidistant, 2–3 cm. apart, opposite to alternate, linear-lanceolate, gradually acuminate; in the upper surface the 3 costae (one primary and two sub-primary) sparingly bristly from the middle upwards; in the lower surface 3–5 costae armed very closely with small, appressed bristles; margins spinulous; the largest leaflets about 30 cm. long, 12–14 mm. wide, rarely larger. *Female spadix* erect at first, 40–50 cm. long, sometimes longer; peduncle short, bifacial about 3–5 cm. long, more or less prickly at least on the edges; primary spathes coriaceous, tubular at first, obliquely truncate, usually bidentate at apex, each protruding a good deal from below; the outermost spathe long persistent, earshaped when opened, narrowed towards the base, more or less armed externally with flat, short, broad, solitary or confluent, seriate or digitate spines on the back and sometimes with a few laminar spines on the edges at the apex; inner spathes smaller, quickly deciduous, gradually less spinose until the terminal ones quite unarmed; axial parts thinly and deciduously rusty-furfuraceous; the main axis divided into 5–10 primary spikelets bearing branches; the latter erect at first spreading in fruits; the lowest primary branch 12–15 cm. long, bearing 4–6 spreading spikelets on each side; other primary branches gradually shorter and with fewer spikelets; the latter more or less angular and sinuous in axis, 4–8 cm. long, spreading when in fruit, the largest with about 5–7 flowers on each side; spathels very short, annular with a triangular acute point on one side. *Involucrophore* distinctly pedicelliform, about 2 mm. long, narrowed towards the base, subtrigonous, porrect in flower, spreading in fruit, with a distant callus in the axil, truncate at apex with an acute limb on one side; involucre flat, round or obscurely angular, housed disciform, raised above the involucrophore; areola punctiform. *Fruiting perianth* obconical-campanulate, with the corolla lobes spreading or deflexed. *Fruit* oblong or elliptic 15–17 mm. long, about 10 mm. in diam., rounded at both ends and mammillate at apex, caudiculate at base; scales arranged in 12 vertical series, of a uniform straw colour, with a narrow darker or lighter intermarginal line and whitish erose margins, grooved in the centre. *Seed* oblong, rounded at both ends, 11–14 mm. long, 6–7 mm. broad, finely pitted, irregularly wrinkled on raphal side; albumen ruminate; embryo exactly basal. *Male spadix* similar to the female, but in the specimens seen shorter; branches and spikelets porrect; flowers soon caducous, none seen.



Daemonorops hystrix (Holttum 32,994).

A, Pars caudicis. B, Fragmentum frondis. C, Fragmentum spadicis apicale. D, Fructus. E, Semen. F, Semen verticaliter discissum.



Daemonorops hystrix (Ridley 11,984).
A, Frondis fragmentum. B, Spadix ante anthesin. C, Spatha basalis. D, Spadix post anthesin.

MALAYA: *Pahang,* Kuala Lipis (Ridley 11,612). *Perak,* Dindings (Ridley 8,404). *Selangor,* Batu Tiga (Ridley 11,984). *Malacca,* loc. incert. (Alvins). *Negri Sembilan,* Tampin Hill (Burkill 2,173); Bukit Kandong (Alvins 1,205 as *Rotan Chicheh*); Beremban (Furtado 33,133). *Johore,* Pontian (Holttum 32,994); Sungai Tebrau (Ridley 11,514); Johore Lama (Ridley on 14–X–1900). *Singapore,* Bukit Mandai (Ridley: 3,480 as *Rotan Sabote;* 3,481; 3,486 as *Rotan Machap Merah;* Goodenough 1,670 as *Rotan Bakau*); Jurong (Ridley on 15–X–1889); Sungai Murai (Goodenough 3,485); Upper Mandai (Ridley 3,484); Garden Jungle (Ridley 5,876; Furtado 30,672); Selitar (Goodenough 1,668); Bukit Timah (Ridley 10,782); Chan Chu Kang (Ridley 1,664); Kranji (Goodenough 1,667 partly); Toas (Ridley 3,479); Tanjong Gol (Ridley 3,483 as *Rotan Sabote*); Yo Chu Kang (Ridley 11,295).

SUMATRA: Cult. in Hort. Bot. Bogor X. E. 6 (Furtado 30,920).

This species varies a good deal in dimensions and spinescence of its different organs, some of the variations are no doubt due to the age of the plant. The vernacular name *Rotan Bakau* has been assigned by Ridley to *D. leptopus* on the misidentification of Goodenough 1670 quoted here by me.

Ridley 10,783 (Bukit Timah) which according to the notes in the sheets, was cited under *D. propinquus,* does not belong to that species, and is *D. hystrix* as far as the leaves are concerned.

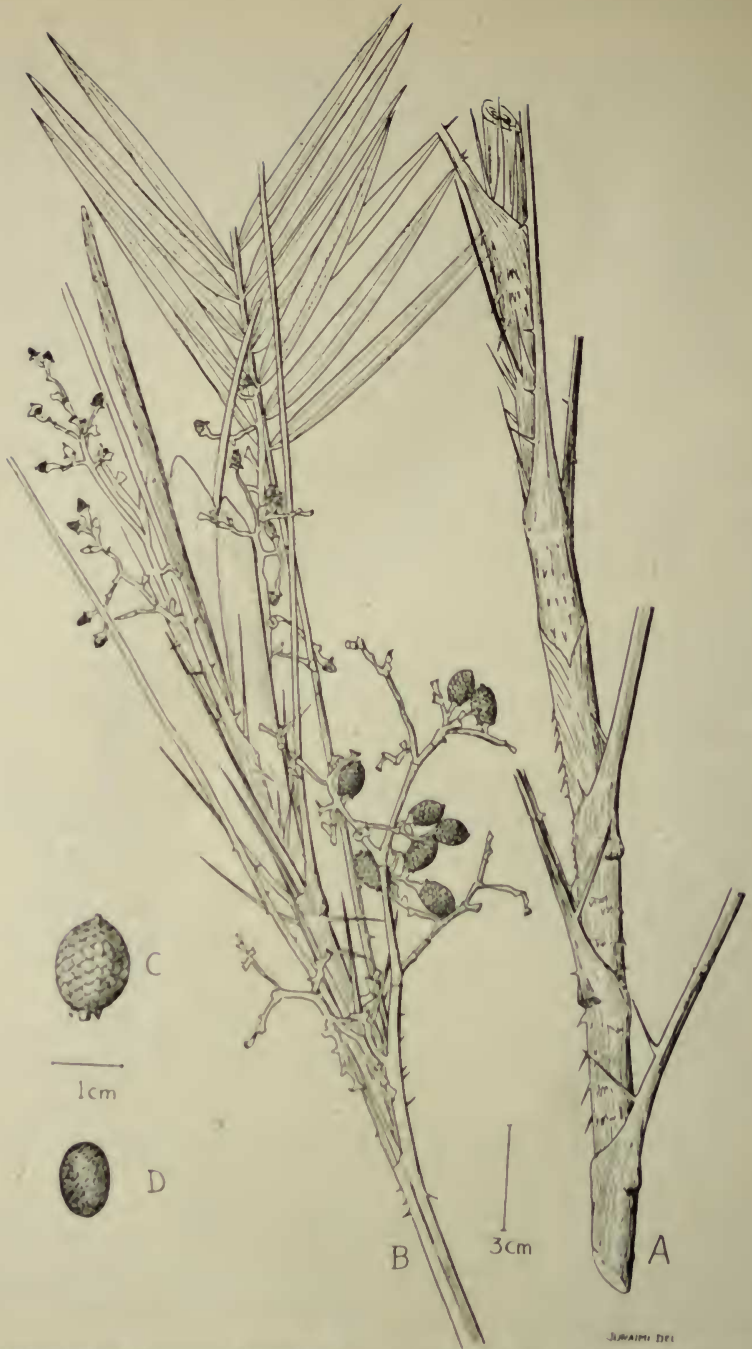
Daemonorops hystrix var. **minor** Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 469 et in Ann. Roy. Bot. Gard. Calc. XII (1911) 138 pl. 56; Ridl., Fl. Mal. Pen. V (1925) 43.

Stem 0–4 m. high, erect, at first, but scandent later, 1–2 cm. through. *Leaf-sheaths* as in the type, but with fewer spines, slightly geniculate in the upper parts; spines at the mouth 6–10 cm. long. *Leaves* 60–90 cm. long including the petiole, ending in a short or no cirrus; the latter up to 30 cm. long. *Leaflets* 14–18 cm. long, 9–10 mm. broad, bristly as in the type. *Spadix* 12–40 cm. long; peduncle short, unarmed or with a few lateral spines; primary spathes feebly armed, often acute at apex. *Fruit* 10–14 mm. long, 8–10 mm. broad; the scales arranged in 15 vertical series.

MALAYA: *Kedah,* Gunong Bintang on the borders of Perak (Haniff 21,052 as *Rotan Sini*). *Kemaman,* Ulu Bendong (Corner: 30,070; 30,071 and 30,194).

This variety differs from the type in that it is a smaller, erect form and that its fruit scales are arranged in 15 vertical series. There are some variations in this variety too. In the Kedah specimen the fruit is shorter than those in the Kemaman specimens.

A young specimen collected in Kemaman (Corner 30,071) shows a tendency to produce branches at the roots so as to form tufts, but the collector's notes state that the plant is



Daemonorops hystrix var. *minor* (*A: Corner 30,194; B–D: Corner 30,070*).

A, Caudicis fragmentum infertile. B, Caudicis fragmentum cum spadicibus fructiferis. C, Fructus. D, Semen.

very common at Ulu Bendong, but it is always solitary (perhaps excluding the short leafy stems around the roots).

The type specimen was collected in the Larut District of Perak (not quoted above).

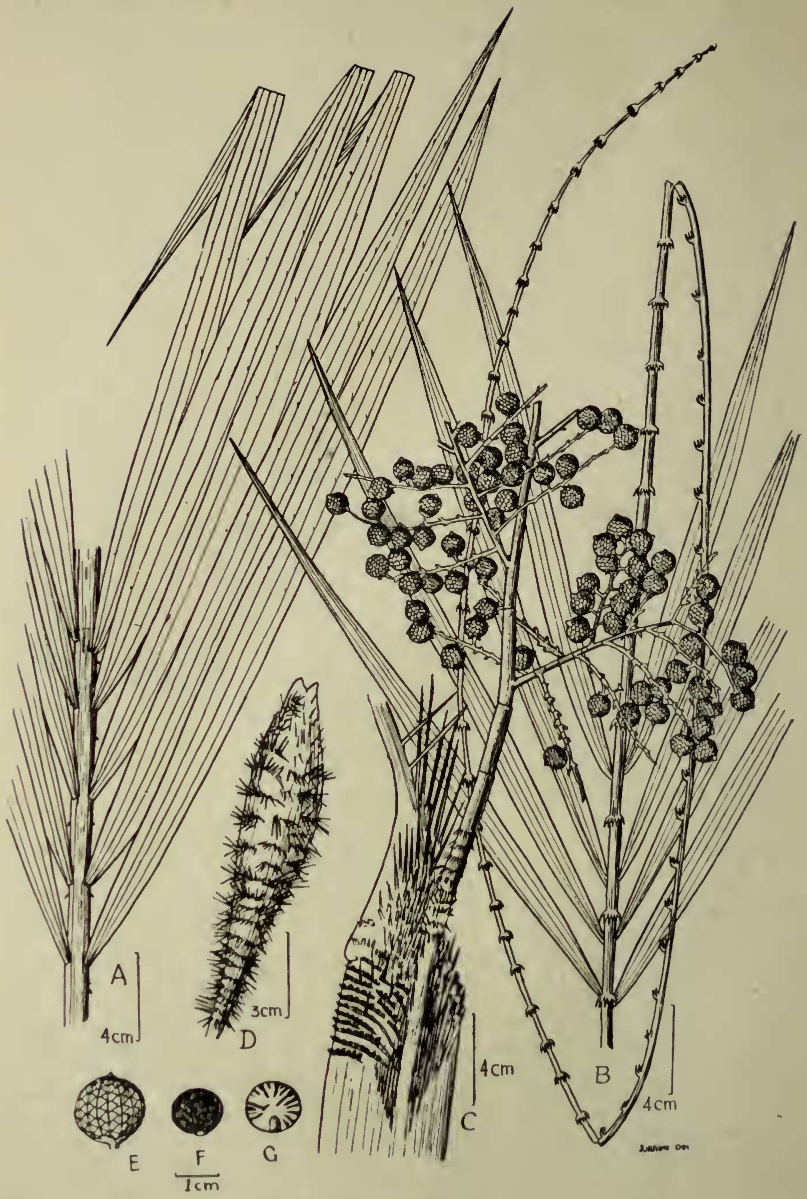
Daemonorops Kunstleri Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 469 et in Ann. Roy. Bot. Gard. Calc. XII (1911) 151 t. 61; Ridl., Fl. Mal. Pen. V (1925) 43; Furtado in Gard. Bull. Straits Settl. VIII (1935) 349.

D. elongatus Bl. *sensu* Ridl., Mat. Fl. Mal. Pen. II (1907) 185, et Flora cit. V (1925) 43.

D. periacanthus Miq. *sensu* Ridl. in Journ. F.M.S. Mus. IV (1909) 87.

D. vagans Becc. in Hook. f., Fl. cit. VI (1893) 465 et in Ann. cit. XII (1911) 153 t. 62; Ridl. Fl. cit. V (1925) 43; Furtado in Gard. Bull. cit. VIII (1936) 365 **syn. nov.**

Stem erect, later semi-scandent, 0·50–8 m. long, with sheaths 2–3 cm. in diam., considerably less in the upper parts of scandent specimens. *Leaf-sheaths* split a long way on ventral side and not gibbous in lower parts of the stem, obliquely truncate at the mouth and gibbous in uppermost leaves, armed densely with unequal, upto 2·5 cm. long more or less seriate, spines, covered all over the lower leaves with dark scurf; spines distinct or united at base to form interrupted, irregular crests, reflexed but a few on ventral side porrect, in the upper leaves intermingled with short, criniform black spiculae, but at the mouth with ascendent up to 5–10 cm. long. *Leaves* about 2 m. long, paripinnate without a cirrus in the lower parts of the stem, gradually shorter but provided with an accrescent cirrus in those of the upper parts; petiole 30–50 cm. long, 1 cm. broad, shorter in the upper leaves, armed along the margins and the dorsal median with short deflexed spines and with much larger spines on the margins at the base; rachis armed with 1–3–5-nate claws. *Leaflets* numerous, equidistant, 2–4 cm. apart, concolorous 11–15 mm. broad, shorter above, linear ensiform, sub-tricostate; on the upper surface midcosta spinulous near the apex only, and one nerve on each side of the costa bristly from near the base; on the lower surface midcosta alone shortly bristly; margins minutely and appressedly spinulous. *Female spadix* about 35–40 cm. long without peduncle, covered in every part with a deciduous rusty tomentum, erect before opening, nodding when in fruit; peduncle very variable in length and also in amature, 5–20 cm. long, more or less densely armed with unequal, small fascicled or whorled, black to dirty yellow-brown spiculae and flat spines; primary spathes thickly coriaceous, bidentate at the apex; the outermost spathe more or less densely armed with unequal spines and sometimes with spiculae also; the second spathe, and sometimes the third also, armed with a few spines; subsequent spathes usually unarmed; spines and spiculae on the spathes concolorous with those on the peduncle; panicle divided into 3–6 primary branches; the latter 3–4 cm. or less apart, 8–12 cm. long, each with 3–6 bifarious, spreading spikelets each side;



Daemonorops Kunstleri (Furtado 33,018).

A–B, Partes frondis. C, Pars vaginae, spadicem ferens. D, Spatha externalis. E, Fructus. F, Semen. G, Semen verticaliter discissum.

spikelets axis sinuous, angular, the longest bearing 6–7 bifarious flowers on each side; spathels annular, obliquely truncate, apiculate. *Involucrophore* distinctly pedicelliform, 2–5 mm. long, angular, erectopatent, narrowed towards the base, flat and truncate at apex, almost without limb; involucre on a level with the involucrophore, flat, discoid, orbicular almost without limb; areola, if present, inconspicuous. *Female flowers* 6 mm. long; calyx shortly cupular, with 3 superficial teeth; corolla 4–5 times as long as the calyx, with the undivided cup often twice as long as the calyx, and with abruptly narrowed segments. *Fruiting perianth* broadly obconical, very shortly pedicelliform. *Fruit* spherical or slightly longer than thick sometimes slightly depressed 14–17 mm. in diam., or slightly less thick; scales arranged in 15–18 longitudinal series, of a uniform yellowish-brown or dirty straw colour, with light-coloured margins, sometimes with an obscure, dark spot at the apex. *Seed* irregularly globular, minutely tubercled, 10–12 mm. in diam.; albumen ruminate; embryo basal. *Male spadix;* primary spathes less armed; the primary and the secondary branches and spikelets closely packed even after the fall of the primary spathes; spikelets 1–2 cm. long, with 2–3 flowers on each side; involucre very shallow, inconspicuous; flowers a few seen, 3 mm. long.

MALAYA: *Kedah,* Kedah Peak (Ridley VI–1893). *Kemaman,* Ulu Bendong (Corner 30,075, male). *Perak,* Larut Hills (Ridley 13–XII–1902); Taiping Hills (Fox in 1899); Maxwell Hill (Burkill and Haniff: 12,646; 12,716; 13,192 and 13,196); Kroh on Bukit Chong (Furtado 33,018); Bruas in Dindings (Curtis in December 1903 as *Rotan Dudok*). *Penang,* Penang Hill (Ridley 10,343); Government Hill (Curtis 2,150); Mount Elvira (Haniff in IV–1901); Balik Pulau (Ridley 7,905). *Pahang,* Telom (Ridley 13,915); Sungai Lemoi (Jaamat 28,190 as *Rotan Kerei*); Fraser's Hill (Holttum 21,526); Wray's Camp (Ridley 16,291). *Selangor,* Sempadang Gap (Burn-Murdoch 13,197); Bukit Kutu (Ridley in V–1896); Kwang (Ridley 13,451); Semangko (Ridley in VIII–1904). *Negri Sembilan,* Bukit Tangga (Nur 11,835); Gunong Angsi (Nur 11,671). *Johore,* Gunong Belumut (Holttum 10,610 and 10,748); Gunong Bechua (Holttum 10,839); Kota Tinggi (Ridley 15,361); Kluang (Holttum 9,257); Kuala Tebrau (Mat. in July 1892); Mount Austin (Ridley in 1904); Mawai by Sungai Dohol (Corner 29,748). *Singapore,* Chan Chu Kang (Ridley on 20–X–1889); Goodenough 1,667); Bukit Mandai (Ridley in 1909); Selitar (Ridley on 9–XII–1890); Bukit Timah (Ridley in 1894).

SUMATRA: Cult. in Hort. Bot. Bogor, XII. C. 104 (Furtado 30,816, male).

DISTRIBUTION: Borneo (fide Beccari).

As shown in my previous paper (1935) there is a good deal of variation in the number of the vertical series in which the fruit scales are arranged. To a certain extent there is some variation on the spinescence on the sheaths and outermost spathes so that these characters are not useful to separate *D. vagans* from *D. Kunstleri.* After comparing the habits of some semi-scandent species which flower and fruit when the stem is young and erect, I have come to the conclusion that *D. vagans* is based on specimens of *D. Kunstleri* at the scandent stage, when it produces a cirrus at the end of the leaves and a gibbosity at the base of the petiole. The real *D. elongatus* Bl. has not been observed in Malaya. The Singapore duplicates of *Ridley 7,905* (Penang), which has been quoted by Beccari (1911 p. 141) doubtfully under it, is *D. Kunstleri.*

Two collections of this species (Selangor, Istagoh in Kuala Lumpur, and Selitar) were cited by Ridley (1907 and 1925) under *D. propinquus;* these were doubtfully referred by me (1935) under *D. micracanthus.*

Daemonorops Kunstleri var. **langkawiensis** Furtado in Gard. Bull. Straits Settl. VIII (1935) 350.

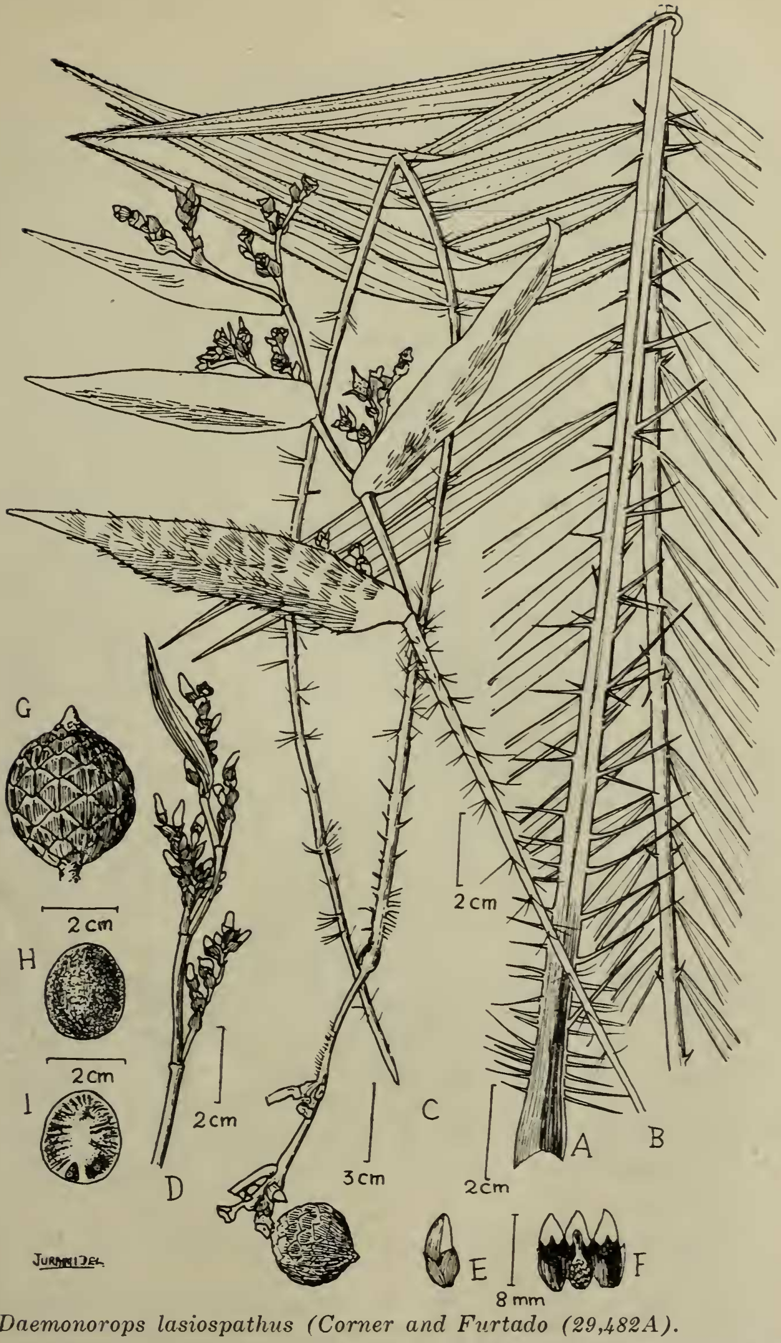
This differs from the type in having its fruit scales arranged in 20 vertical series.

MALAYA: *Langkawi Island*, Gunong Raya (Haniff and Nur 7,119); Kesap (Haniff 15,911 vern. nom. Rotan Jeren); Burau (Ridley 15,884).

Daemonorops lasiospathus Furtado in Gard. Bull. Straits Settl. VIII (1935) 351.

D. scapigerus Becc. *sensu* Ridl., Fl. Mal. Pen. V (1925) 43 p.p.

Stem solitary, acaulescent or up to 1·5 m. tall, erect, with sheaths 3–3·5 cm. through. *Leaf-sheaths* not gibbous, fugaciously covered with tobacco-brown furfur, obliquely truncate at apex, unarmed immediately below the base of the petiole in other parts armed with laminar, straw-coloured, solitary or subseriately approximate, 1–2·5 cm. long spines. *Leaves* about 1·5–2 m. long without any cirrus or with a tendency to form one, petiole 35–40 cm. long, ventrally channelled towards the base and flattened higher up, dorsally convex and unarmed, along the margins armed with up to 6 cm. long spines, the latter if seated towards the base somewhat closer, longer and spreadingly porrect and if seated towards upper half distant, about 1–2 cm. long and reflexed; rachis about a metre or more long, armed below along the two margins each with a row of small solitary, rarely digitate, reflexed hooks, but the topmost portion of the rachis usually unarmed, like the entire rachis in the upper surface. *Leaflets* several, closely equidistant, 2–3 cm. apart, ensiform or lanceolate-linear, 25–30 cm. long, 18–20 mm. broad, narrowed towards both ends, contracted at apex into a long bristly tip, spinulose in the margins; in the upper surface the median costa alone remotely setose towards the apex, unarmed in other parts, median costa and two sub-primary ones very prominent; in the lower surface paler, all 7–9 costae very slender, 5 of which are closely and conspicuously setose, setae closer in the median costa than in the sub-primary ribs. *Female spadix:* peduncle variable in length, 25–55 cm. long, biconvex, deciduously covered with ferrugineous furfur, usually armed with up to 2·5 cm. long, spreading or slightly reflexed spines (those towards the base longer and sometimes solitary, those towards the apex usually shorter, digitate or seriate); the portion included in the spathes 5–15 cm. long,



Daemonorops lasiospathus (Corner and Furtado (29,482A).

A, Folium. B, Spadix femineus. C, Spadix fructiferus. D, Fragmentum spadicis floriferus. E, Flos masculus. F, Flos apertus ut staminodia pistillumque appareant. G, Fructus. H, Semen. I, Semen verticaliter discissum.

divided into 3–5 primary branches; primary spathes membranous, scaphoid or strap-shaped when open, deciduous, 15 cm. long or less, covered with soft, slender, capilliform, sinuous, up to 2 cm. long hairs arranged in short series and united at base; the outermost armed also with occasional stiff spines seated in the midst of the long hairs; the other spathes gradually shorter and less hairy; primary branches 1·5–5 cm. long; secondary spathes membranous, short, annular 5–10 mm. long, with a broad, longer apex on one side; spikelets 2–3 on each primary branch, each 10–15 mm. long, bearing 3–5 congested flowers; spathels annular, obliquely truncate. *Involucrophore* sessile, cupuliform, enclosed or a little exsert; involucre developed into one-sided, auriculiform cup, truncate on the other side, sometimes deep to the torus disc. *Female flowers* ovate, 5–8 mm. long; calyx half the length of the corolla, triparitite, striate; corolla segments coriaceous, not striate. *Fruiting perianth* explanate. *Fruit* spherical or ovate globose, gradually or abruptly beaked at apex, without the beak 22–25 mm. long, 20–25 mm. in diam., scales arranged in 13–15 vertical series, channelled in the centre, dark with violet tinge when young, gradually turning straw-coloured with broad, dark marginal lines. *Seed* ovoid, 17–18 mm. long, 15–17 mm. broad, 15–16 mm. thick; albumen ruminate, with whitish homogeneous core; embryo basilar. *Male spadix:* peduncle less armed or almost unarmed, slender. *Male flowers* 6–8 mm. long, in calyx about 1/2–1/3 of the corolla.

MALAYA: *Johore,* Sungai Kayu Ara (Corner and Furtado 29,482A, type, and 29,494 male); Ulu Kahang (Holttum 10,920). BORNEO: *Sarawak,* Siul (Ridley in September 1905); Matang (Ridley in July 1905).

In many respects this species resembles *D. scapigerus* Becc., but is easily distinguished from the latter in the absence of laminar crests on leaf-sheaths and smaller and more armed leaflets. The primary spathes in *D. scapigerus* are described to be quite unarmed, whereas in *D. lasiospathus* all the primary spathes are provided with long acicular hairs.

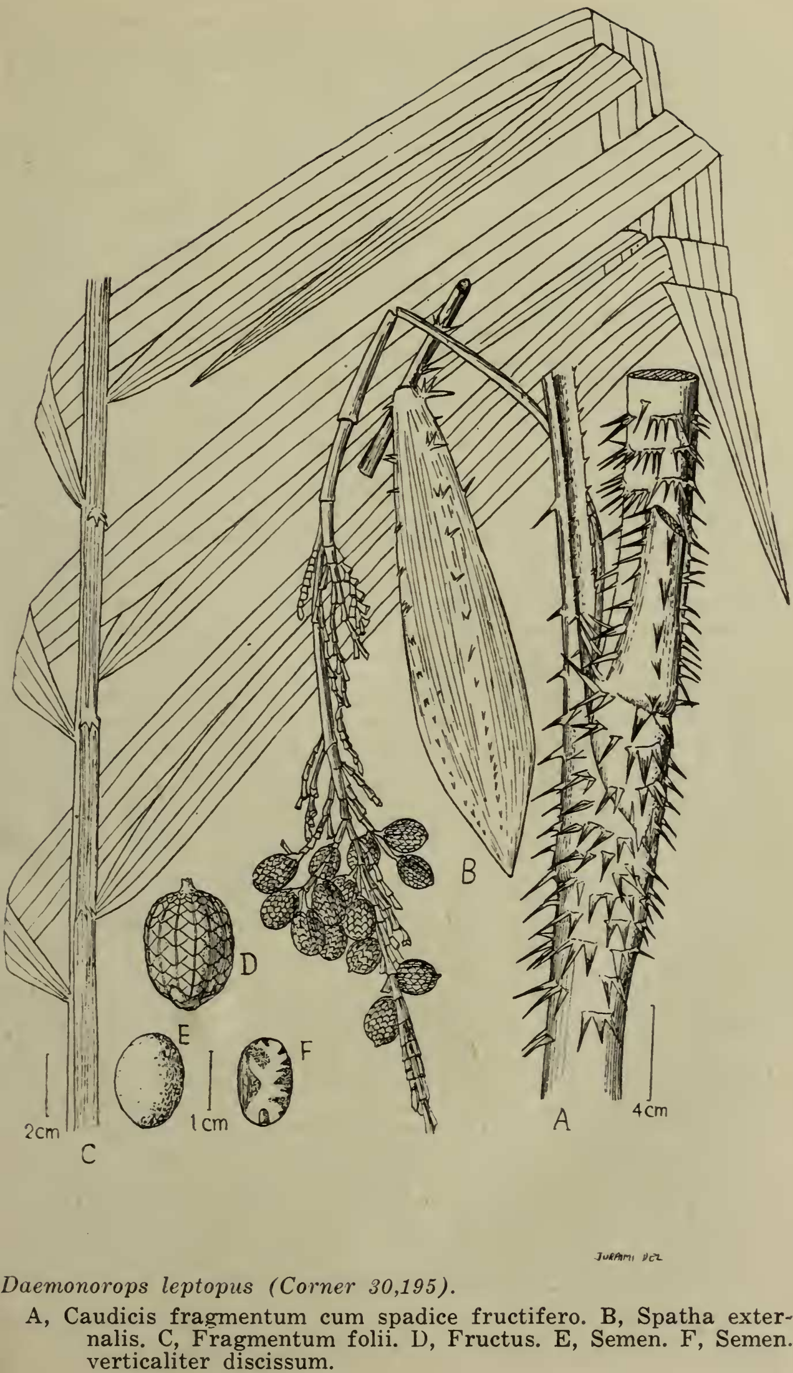
Daemonorops leptopus (Griff.) Mart., Hist. Nat. Palm. III 2nd. ed. (1849) 206 et (1850) 329; Miq., Fl. Ind. Bot. III (1855) 99; Ridl., Mat. Fl. Mal. Pen. II (1907) 182 p.p.; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 128 pl. 52; Ridl., Fl. Mal. Pen. V (1925) 42 p.p.; Furtado in Gard. Bull. Straits Settl. IX (1937) 163 sub *D. congestus.*

D. congesta Ridl., Mat. cit. II (1907) 179 et Flor. cit. V (1925) 40.

D. propinquus sensu Ridl. in Jour. Roy. As. Soc. Str. Br. 33 (1900) 175.

Calamus leptopus Griff. in Calc. Journ. Nat. Hist. V (1844) 73 et Palms Brit. Ind. (1850) 82 pl. CCV A & B.

Stem high scandent, 20 m. or more long, with sheaths 2–6 cm. through. *Leaf-sheaths* thick geniculate, woody, hard, dirty-straw coloured, almost unarmed in older specimens excepting a few



Daemonorops leptopus (Corner 30,195).

A, Caudicis fragmentum cum spadice fructifero. B, Spatha externalis. C, Fragmentum folii. D, Fructus. E, Semen. F, Semen verticaliter discissum.

rigid spines arranged in a line below the gibbosity, densely armed in younger specimens with triangular rigid solitary or subseriately united at base, reflexed spines arranged, on the gibbosity and sometimes for a short length below it, in three rows in line with the dorsum and the two margins of the petiole. *Leaves* large, 2·5–3 m. long, excluding 80–125 cm. long cirrus; petiole 50–80 cm. long, remotely armed in a line along the dorsal median with usually solitary hooks, and along the margins with short and occasionally long .spines, smooth usually in the upper surface, but sometimes provided with tuberculiform spines; rachis armed beneath with 3–5-nate claws towards the apex, solitary towards the base. *Leaflets* numerous, equidistant alternate or sub-opposite 3–7 cm. apart, slightly paler beneath, lanceolate, gradually ending into an acuminate bristly tip, smooth on both surfaces except for a few bristles in the midrib towards the apex on both sides or in the upper surface only; spinulous on the margins; the largest 40–50 cm. long, 2·5–3 cm. broad. *Female spadix* spuriously axillary, about 80–100 cm. long, nodding or recurved after flowering, divided into 4–7 main branches; the outermost spathes bidentate, woody, long persistent, almost smooth or more or less armed with short or tuberculiform, solitary or ,digitate spines along the two ridges and occasionally also along one of the margins; other primary spathes bidentate or obscurely so, woody or thickly coriaceous, almost polished; primary branches 8–20 cm. long, divided into 4–6 spikelets on each side; spathels obliquely infundibuliform, acutely angular, extended on one side into a triangular point. *Involucrophore* obconical with a triangular apex on one side; involucre cupular at first, very shallow later in fruit; areola with acute borders and with a punctiform scar. *Female flowers* 5–6 mm. long; calyx striate; corolla 1/3 longer than the calyx. *Fruiting perianth* almost explanate with a small, subcallous base. *Fruit* ovate-oblong or oblong, 16–18 mm. long, about 11–12 mm. broad, rounded at both ends, abruptly beaked; scales arranged in 12–15 longitudinal series, dull, cinnamon-brown colour, broader than long, narrowly channelled along the centre and having more or less fine dark margins. *Seed* oblong ovate-oblong, slightly flattened, 11–14 mm. long, 9–10 mm. broad, 6–7 mm. thick, rounded at both ends, rugose surface; albumen ruminate embryo basal. *Male spadix* very slender, with cupressiform, porrect branches. *Involucre* enclosed within its spathel, semi-cupular, bidentate. *Male flowers* linear, oblong, about 5 mm. long; corolla 2½ to 3 times as long as the calyx.

MALAYA: *Kemaman,* Ulu Bendong (Corner 30,195 and 30,196). *Perak,* Tapah Hill (Furtado 33,093); Gopeng (Kunstler 5,919); Larut Hills (Ridley in December 1902). *Pahang,* Bukit Chemaga (Henderson 19,476 as *Rotan Kanol* in Sakai). *Malacca,* Sungai Udang (Ridley and Goodenough 1,635). *Negri Sembilan,* Bukit Kandong (Alvins 1,246 as *Rotan Murusek*). *Johore,* Sungai Kayu (Kiah 32,412); Batu Pahat (Ridley 11,210); Kuala Tebing Tinggi (Ridley 11,204); Sungai Tebrau (Ridley 11,519); Gunong Pulai (Ridley 12,200). *Singapore,* Kranji (Goodenough in 7–X–1889); Bukit Mandai (Ridley in 1901; Goodenough 1,670 as *Rotan Bakau;* Mat. in 1894); Upper Mandai (Ridley 3,497); Bukit Panjang at Stagmount (Ridley, type of *D. congesta*); Jurong (Corner in XI–1932 and III–1933); Bukit Arang (Goodenough 1,666); Ang Mo Kio (Ridley in 1894).

Some of the specimens (e.g. from Langkat) which Ridley quoted under this species are excluded from here.

Daemonorops longipes (Griff.) Mart., Hist. Nat. Palm. III, 2nd. ed. (1849) 205 & 329 pl. 174 fig. V. 23; Miq., Fl. Ind. Bot. III (1855) 93; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 472; Ridl., Mat. Fl. Mal. Pen. II (1907) 184; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 202 tt. 92 & 93. Ridl. Fl. Mal. Pen. V. (1925) 44.

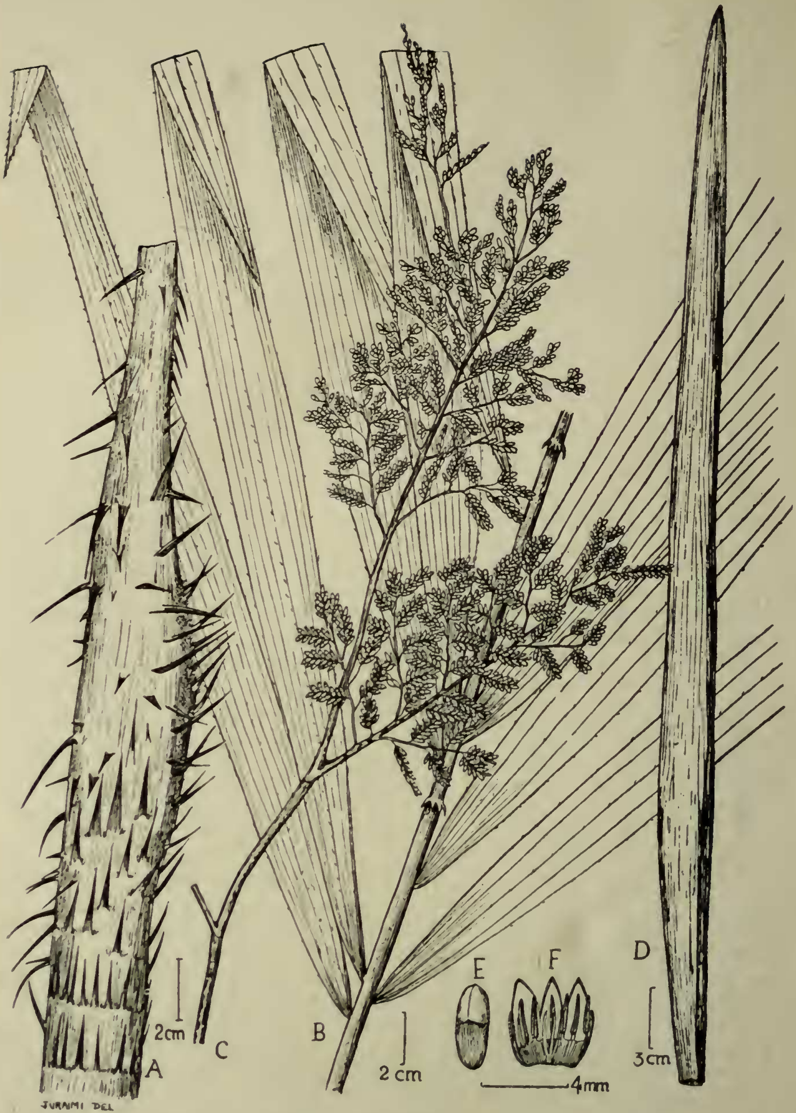
D. geniculatus (Griff.) Mart. *sensu* Ridl., Mat. cit. II (1907) 184 et Flora cit. V (1925) 44, *partim.*

D. strictus Bl., Rumphia III (1847) 19 pl. 163A; Miq., Fl. Ind. Bot. III (1855) 86 et Prodr. Fl. Sum. (1860) 255.

Calamus longipes Griff. in Calc. Journ. Nat. Hist. V (1845) 68 et Palms Brit. Ind. (1850) 78 (excl. Rumph's cit.) pl. CCIII A, B.

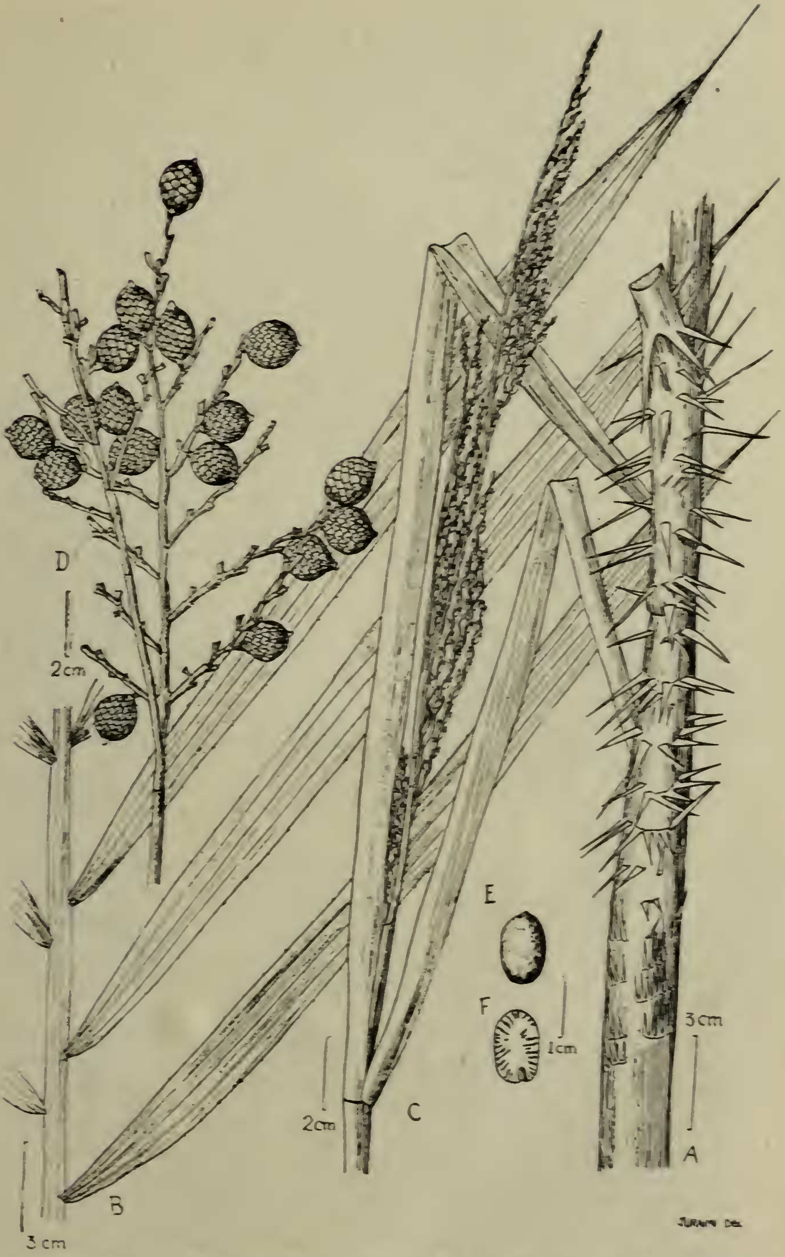
C. strictus (Bl.) Miq., De Palm. Arch. Ind. (1868) 28.

Stems tufted, semi-scandent, 3–4 m. long, with leaf-sheaths 3–3·5 cm. in diam. *Leaf-sheaths* not gibbous at first, but obscurely in leaves produced late in life of the stem, very obliquely truncate, armed with long, flat, obliquely seriate, schistaceous, 3–7 cm. long spines, sometimes mixed in the series with small, dark criniform spiculae; spines fewer on the sheaths of the later leaves, rather long at the base of the petiole, and shorter but broader in the dorsum. *Ocrea* rather long along the margins of the sheaths of the lower leaves, reduced to a short, semi-annular margin in the later leaves, densely covered with minute, black, criniform spiculae. *Leaves* 1·5–2·5 m. long below the cirrus; the latter wanting in the lower leaves, present and strongly clawed in the uppermost leaves; petiole almost polished, 30–60 cm. long biconvex, somewhat flattened or obscurely ridged above and broadly channelled at the very base, armed with long, irregular decrescent spines at the very base and along the margins with solitary spines in the median of the upper part of the dorsum; rachis armed dorsally with 1–3–5-nate, black-tipped claws. *Leaflets* numerous, more or less inequidistant, often geminate or almost equidistant in some parts and 3–4 cm. apart, ensiform or elongate-lanceolate, broadest below the middle, ending in a filamentous tip, not distinctly 3-costulate; the midcosta bristly on both surfaces, but the two sub-primary nerves (one on each side of the midrib) usually bristly above and occasionally so below; the largest 30–40 cm. long, 22–28 mm. broad; upper ones gradually decrescent. *Female spadix:* peduncle 40–80 cm. long, flattened, acutely two-edged, unarmed, 10–15 mm. broad; flowering panicle 35–50 cm. long, divided into 3–4 primary branches; axis deciduously rusty furfuraceous primary spathes cinnamon-brown colour, glabrous, unarmed; lower primary branches largest, 18–25 cm. long, (longer in fruits) with 5–8 distichous spikelets on each side; secondary spathes short, annular with a triangular apex on one side; spikelets patent or erecto-patent, the longer ones 5–10 cm. long (fruiting ones longer), with 5–10 flowers on each side; spathels shortly annular, with a triangular apex. *Involucrophore* pedicelliform, 2–5 mm. long, obsoletely annular, truncate with a short apex on one side; involucre shallowly cupular, entire, immersed on one side, exsert on the other.



Daemonorops longipes (Furtado 30,831).

A, Frondis vagina. B, Pars folii. C, Spadices fragmentum masculus. D, Spatha externalis. E, Flos. F, Flos apertus ut staminodia appareant.



Daemonorops longipes (A, B and D: Burkill 1,432; C: Fox 11,297).

A, Caudicis fragmentum cum vagina frondis. B, Frondis pars. C, Spadicis floriferus cum spatha externale. D, Spica cum spiculis fructiferis. E, Semen. F, Semen verticaliter discissum.

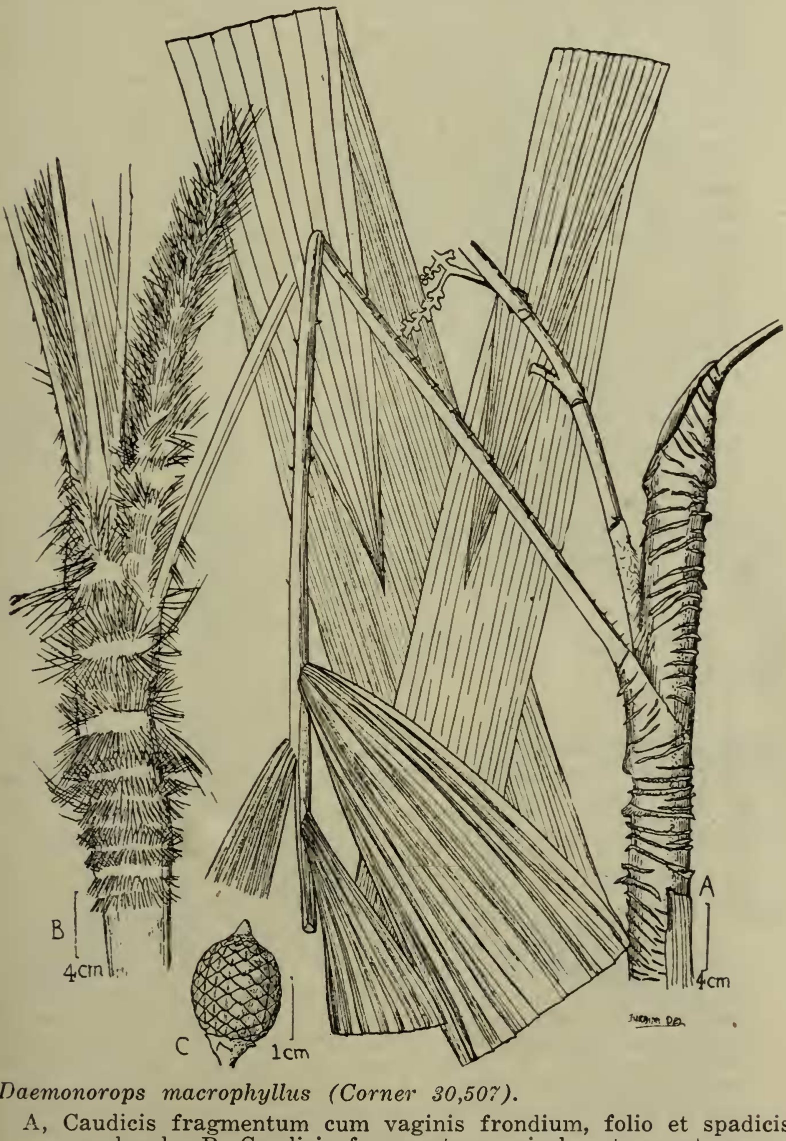
Female flowers 5–7 mm. long; calyx cyathiform, obsoletely 3-toothed, striate; corolla twice as long as the calyx. *Fruiting perianth* distinctly pedicelliform. *Fruit* oblong elliptic, abruptly beaked, 15–18 mm. (23–25 mm. long including the beak and the perianth), 13–15 mm. in diam.; scales in 15 longitudinal series, dull, dirty yellowish or reddish-brown in colour, slightly darker near the margin, whitish in the margins. *Seed* 15–17 mm. long, 9–11 mm. broad, 7–10 mm. thick, slightly flattened on one side, minutely pitted on the surface albumen deeply ruminate; embryo basal. *Male spadix* divided into cupressiform branches, with spikelets borne generally on the secondary branches, at least in the lower primary branches, slightly longer than the female. *Involucre* short, shallowly cupular, orbicular or obscurely bidentate. *Male flowers*, bifarous, closely packed at an angle of about 45° on the spikelets, 4–5 mm. long, with the corolla about twice as long as the calyx.

MALAYA: *Negri Sembilan*, Tampin Hill (Burkill 2,181). *Malacca*, Bukit Sedenan (Holttum 9,661 as *Rotan Dahan;* Bebas 78 as *Rotan Batu*, and 79 as *Rotan Kembong*); loc. incert. (Alvins 487 as *Rotan Dudoh*); China Puteh (Alvins 799 as *Rotan Sabot*); Pulau Rumbia (Seimund); Selandan (Ridley 10,794); Sungei Tebong (Burkill 1,432). *Pulau Tioman* off Pahang, Juara Bay (Burkill 1,134); Ayer Surin (Henderson 21,699); Durian Sabak (Nur 18,833). *Johore*, Sungei Surnagah in Muar (Fox 11,296 and 11,297 and 11,298); Tempayan River (Ridley 13,296); Mount Austin (Ridley in 1906); Kangka Sedili Kechil (Corner 28,598); Tanjong Kopang (Ridley 6,286); Castlewood (Ridley 11,614); Sungei Segal (Fox in 1901); Sungei Tebrau (Ridley 11,516), Bukit Muar (Feilding). *Singapore*, Selitar (Ridley 6,292); Bukit Timah (Ridley 6,902 and 9,143); North Selitar (Ridley on 9. XII. 1890); Bukit Mandai (Ridley 3,491 as *Rotan Sepah*); Changi (Ridley 3,496 as *Rotan Chochor*, and 6,276 partim); Chan Chu Kang (Ridley: 3,482; 3,490 as *Rotan Machap;* 3,500; and 4,623; Goodenough 1,668).

SUMATRA: East Coast: cult. in Hort. Bot. Bogor XII D. 4 (Furtado 30,831).

Daemonorops macrophyllus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 470 et in Rec. Bot. Surv. Ind. II (1903) 227; Ridl., Mat. Flor. Mal. Pen. II (1907) 187 as indeterminable; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 185 t. 80; Ridl., Fl. Mal. Pen. V (1925) 46.

Stem scandent, about 15 m. long, 3 cm. in diam. *Leaf-sheaths* strongly gibbous above, densely bristly-spinulous at the mouth, furnished with several, membranous, spiculiferous reversed collars, in the upper half with an equal number, smaller collars in close proximity to the former but with spiculae turned upwards, crossing spiculae of the opposing collar; often a small collar having horizontal spiculae is interposed between these opposing pairs; spiculae unequal, brittle, slender, criniform, blackish or brownish, the longest ones about 6 cm. long. *Leaves* with 3–6 leaflets on each side, arranged in opposite or sub-opposite, rarely alternate, groups of 2–3 each, sometimes only one leaflet on each side in the group; cirrus about 1–1·20 m. long; petiole 40–60 cm. long, longer in the juvenile specimens, with rounded edges, armed along the margins and at the base with a few spines, higher up in the dorsum with small, solitary claws; rachis 30–75 cm. long, armed with small solitary or digitate claws. *Leaflets* elliptic lanceolate, almost equally tapering on both sides, with triangular, or sometimes contracted, bristly apex, 50–65 cm. long, 8–12 cm. broad, 6–8 costate, smooth on both surfaces, minutely spinulous along the margins; the leaflets towards the leaf-apex usually smaller, 25–40 cm. long up to 5 cm. broad, 3–5 costate. *Female inflorescence* freed close to the axil of the axillant leaf, nodding,



Daemonorops macrophyllus (Corner 30,507).

A, Caudicis fragmentum cum vaginis frondium, folio et spadicis pedunclo. B, Caudicis fragmentum apicale, ut armatura appareant. C, Fructus.

paniculate, about 75 cm. long, with 7–8 spikelet-bearing branches; unsheathed base of the peduncle bifacial, about 5 cm. long, armed along the margins and occasionally on the dorsal side with criniform spines, the dorsal spines often united at base to form short, interrupted crests; primary spathes deciduous tubular before anthesis, obliquely truncate covered with long, unequal blackish criniform spines, often arranged on short, interrupted distant crests at the base; in young stages the space between the crests covered by ants with special fluff to form galleries; primary branches 10–18 cm. long, having 4–7 bifarious, alternate spikelets on each side; axis of the primary branches and spikelets nearly quadrangular, deciduously furfuraceous; secondary and tertiary spathes reduced to very small annular rings. *Involucrophore* pedicelliform 2–4 mm. long, angular, slightly thicker towards the apex, truncate with an acute point on one side; involucre very slightly exsert, truncate, surmounted with a slightly narrower disc corresponding to the basal depression of the calyx seated on it; areola depressed with a conspicuous scar. *Fruiting perianth* pedicelliform, campanulate; corolla twice as long as the calyx. *Fruit* only immature seen, oblong, shortly beaked at apex, without beak and the pedicelliform perianth, 15 mm. long 10–12 mm. in diam.; scales yellowish-brown, slightly darker in the margins, convex, channelled in the centre, rounded at apex, arranged in 18 vertical series; seed not in its definitive stage yet, ruminate.

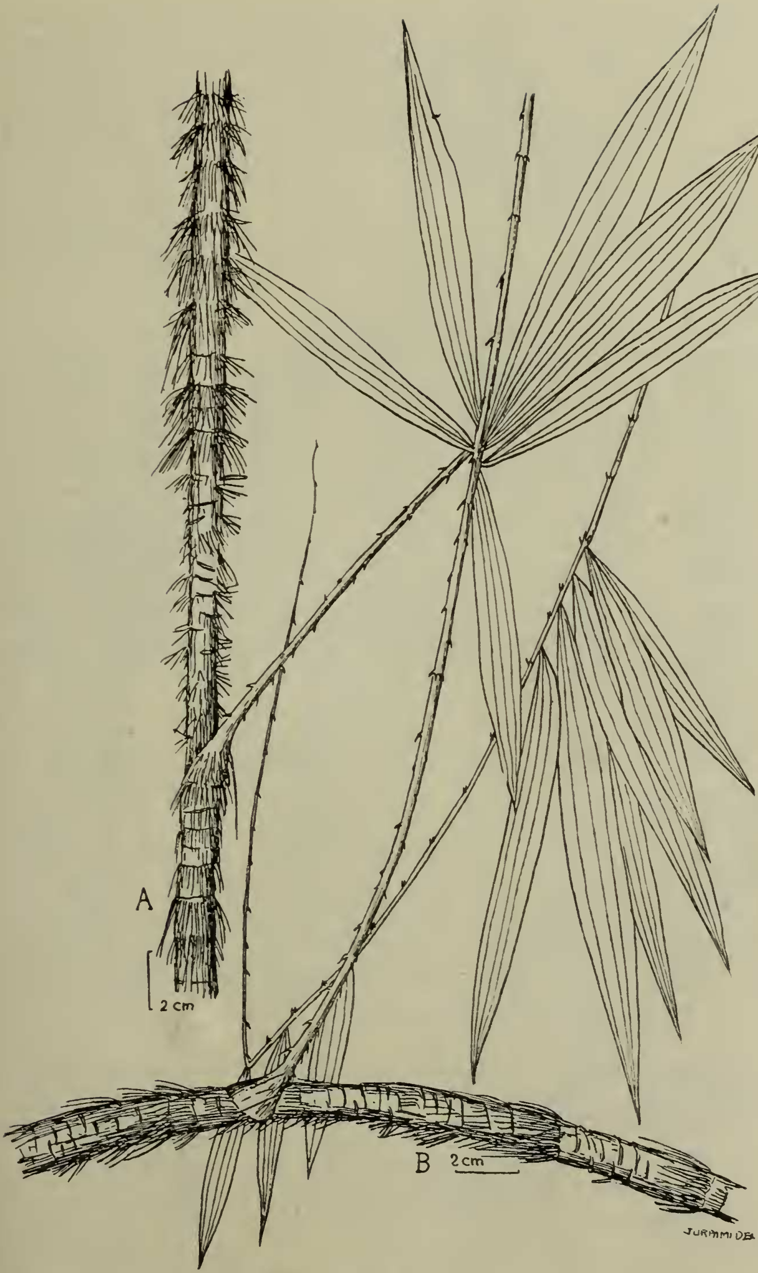
MALAYA: *Kemaman*, Bukit Kajang (Corner 30,507 and 30,563, as *Rotan Lilin*). This species was known only from the sterile material collected by Scortechini in Perak. Corner 30,563 has fruits and Corner 30,507 contains a young spadix enclosed in its spathes.

In young stages the spaces between the rows of spines on the leaf-sheaths and the spathes are lined by ants with peculiar fluff, excreted perhaps from their bodies, to form closed galleries for their habitation. The spadix peduncle becomes free soon after reaching the mouth of the axillant leaf-sheath.

Daemonorops oligophyllus Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 470, in Rec. Bot. Surv. Ind. II (1902) 227 et in Ann. Roy. Bot. Gard. Calc. XII (1911) 182 pl. 78; Furtado in Gard. Bull. Straits Settl. VIII (1935) 358.

D. sabut Becc. *sensu* Ridley., Fl. Mal. Pen. V (1925) 27 *pro parte.*

Stem slender, scandent, with sheaths 9–12 mm. in diam. *Leaf-sheaths* gibbous above, unarmed or almost so in the gibbous portion and at the mouth, furnished below with 3–4 complete, membranous, reflexed collars formed by the confluent bases of numerous, very slender, needle-like, unequal, black or spadiceous, shining spiculae, in addition to many, complete or more or less interrupted, rows of similar, shorter, reflexed, confluent, ultimately deciduous spiculae. *Leaves* small, 70–90 cm. long including the petiole and the cirrus; petiole 20–32 cm. long, biconvex, armed along the margins with very small prickles and with solitary or digitate claws along the dorsal median; pinniferous rachis short,



Daemonorops oligophyllus (ex tab. Beccarii delineata).
A, Caudicis pars cum folio. B, Ibid. ut foliola basalia ad basin valde approximata appareant.

armed below with 3–5-nate claws. *Leaflets* 10–13 in all with 10–11 leaflets arranged in two remote, opposite or sub-opposite groups 9–13 cm. apart, the basal group having 3 leaflets on each side, the best group with 3 leaflets on one side and 1–2 on the other, the remaining leaflets very distant, solitary, towards the apex, 10–15 mm. apart in each group, papyraceous, concolorous on both surfaces, elliptic-lanceolate or sub-oblanceolate, acute at their bases and rather shortly, at times abruptly, acuminate into a bristly tip, smooth except appressedly spinulous along the margins and sparingly in the midrib above; the largest leaflets in the basal group, 10–16 cm. long 15–20 mm. broad; the terminal solitary leaflets diminutive. *Spadix:* flowers and fruits not known.

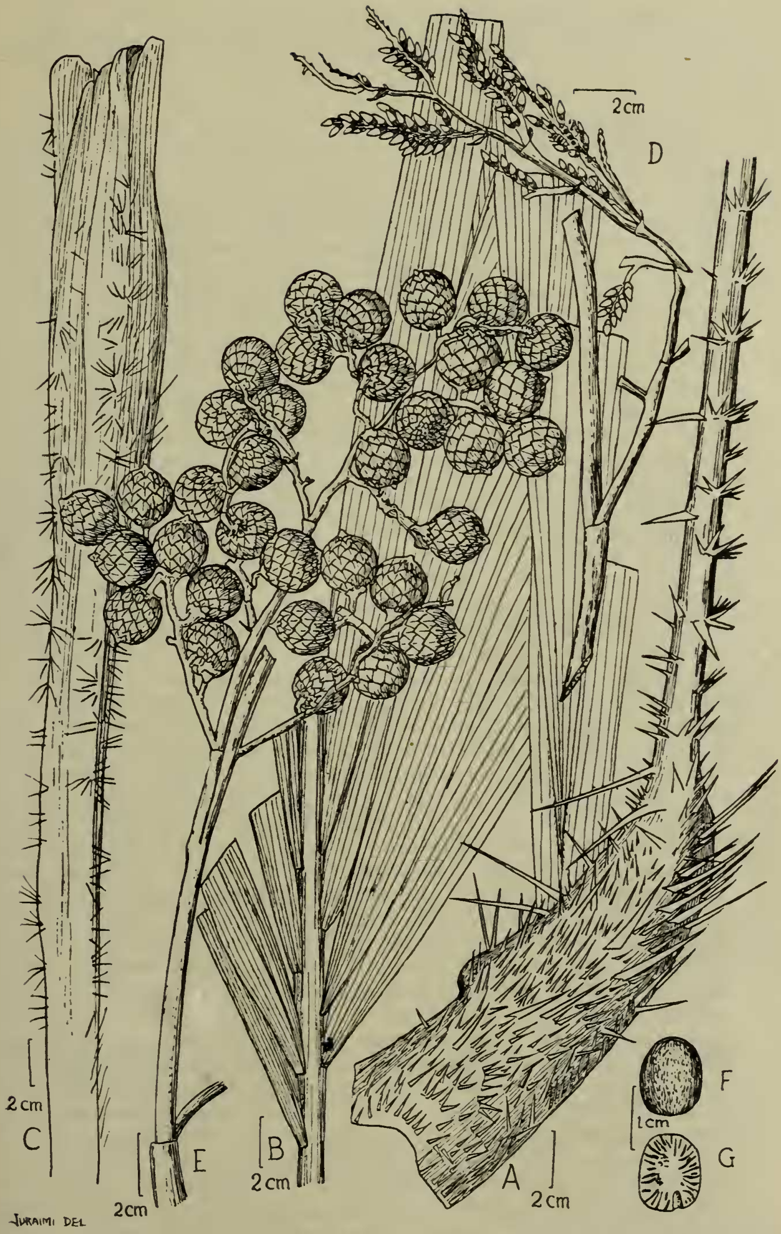
MALAYA: *Perak* (Scortechini in Herb. Beccari.).

This species is known only from the type collection which consists of two leaves with their sheaths. I have studied it only from Beccari's description and the plate, and have used the latter to supplement the details in the description. There is nothing that will approach this species except *D. Forbesii* from Sumatra, but the leaf-sheaths of the latter have collars which are pointing both ways (some reflexed and some porrect), whereas in *D. oligophyllus* the collars all point downwards. Besides in *D. Forbesii* the leaf-sheaths are armed at the mouth and the leaflets are also different; the claws on the leaf-rachis and the petiole are solitary except in the terminal half of the rachis where they are ternate or 5-nate.

Though Beccari has not given the exact type locality of this species, Ridley (1925) states that it was collected on Gunong Tambang Batak, Perak. Ridley was inclined to think that *D. oligophyllus* is a juvenile form of *D. sabut,* but the digitate claws on the petiole and the lower portion of the leaf-rachis and the long cirrus at the end of each leaf are characters that lead me to keep this species quite distinct from *D. sabut.* Besides even in very young specimens seen of *D. sabut* the leaflets are larger and those of the lower-most group are divergent.

Daemonorops periacanthus Miq., Prodr. Fl. Sum. (1860) 256 et 593; Becc. in Rec. Bot. Surv. Ind. II (1902) 229; Ridl., Mat. Fl. Mal. Pen. II (1907) 185 quoad specimen typicum tantum; Becc. in Ann. Roy. Bot. Calc. XII (1911) 197 tt. 88–90; Ridl., Fl. Mal. Pen. V (1925) 44; Furtado in Gard. Bull. Straits Settl. VIII (1935) 351 sub. *D. lasiospathus.*

D. dissitophyllus Becc., Nelle Foreste di Borneo (1902) 608 et in Rec. Bot. Surv. Ind. II (1902) 229; Ridl., Mat. Fl. Mal. Pen. II (1907) 183.



Daemonorops periacanthus (A–C: Furtado 32,280; D–G: Corner 29,317).

A, Fragmentum petioli basale. B, Pars folii mediana. C, Spadix ante anthesin. D, Fragmentum spadicis floriferum. E, Spadicis spica fructifera. F, Semen. G, Semen verticaliter discissum.

D. scapigerus Becc. *sensu* Ridl., Fl. cit. V (1925) 43.
Calamus periacanthus Miq., De Palm. Arch. Ind. (1868) 22 & 28.

Stem scandent, tufted, about 15 m. long, with sheaths 3–3·5 cm. in diam. *Leaf-sheaths* slightly gibbose below the petiole, armed with a few, large, light-coloured, flat, 2–4 cm. long, solitary, spreading or deflexed spines scattered amongst numerous crowded, ascendent, dark-brown, rigid, 10–15 mm. long or shorter spiculae; at mouth truncate and armed with several, large, light-coloured, porrect 8–10 cm. spines. *Leaves* large, about 2 m. long or more with nearly equally long, powerfully clawed cirrus; petiole about 60–80 cm. long, armed irregularly on both surfaces and along with a few scattered, short and large, solitary or shortly seriate spines (ascendent above, somewhat deflexed in the lower surface); rachis about 1–1·50 m. long, armed above only in the basal part, in the lower surface with 3–5-nate claws. *Leaflets* numerous, arranged in sub-opposite groups of 2–5 each, almost equidistant and 4–5 cm. apart in each group, (each group 10–20 cm. apart), glossy green above, paler and dull beneath, somewhat longitudinally plicate, ensiform or narrowly lanceolate, broadest in the middle, gradually cuneate at base, acuminate, subulate, slightly bristly at apex (one secondary nerve on each side of the midnerve stronger than the others), smooth on both surfaces, or occasionally spinulous in the midcosta near the apex, in the margins setulose in the upper half, the largest about 50 cm. long and 4 cm. broad. *Female spadix* straight, erect, slightly sinuate and angular in axis, borne on a peduncle variable in length but often 30–40 cm. long; the latter bifacial, flattened on the axial side, slightly convex on the abaxial side, covered with deciduous brown fluff, armed along the margins with a few fascicles of flabby, light-coloured, black tipped, slender spines; primary spathes deciduous, the two basal spathes not seen, others largest 15–28 cm. long, with 4–5 erecto-patent spikelets on each side, others gradually decrescent, those at the apex being reduced to a mere spikelet only; secondary spathes very small, annular, produced on one side into a triangular point; spikelets callused in the axil, sinuous in axis, the largest 5–7 cm. long with 5–6 distichous flowers on each side; spathels short, very loose, with a triangular apex, *Involucrophore* distinctly pedicelliform, 3–5 mm. long, with short, obliquely infundibuliform apex; involucre shallowly cupular, broader on the side of areola; the latter niche-like, depressed. *Female flowers* 6 mm. long; calyx cupular, obsoletely 3-toothed, not striate, nearly half as long as the corolla. *Fruiting perianth* almost explanate with a callused base. *Fruit* spherical or nearly so, 15–18 mm. in diam., shortly beaked; scales in 15 vertical series, yellowish with suffused red or reddish-brown in parts, darkened in the intramarginal line, paler in the margins. *Seed* globular, or ovate very minutely tubercular and pitted, 9–14 mm. long, 9–12 mm. in cross diam., ruminate, with the basal embryo. *Male spadix* similar but somewhat longer, covered with deciduous, floccosely brown furfur in its axis and of the branches and spikelets; outermost primary spathe splits longitudinally along the entire ventral side, bicarinate on the back, more or less armed along the keels and sometimes also on the ventral side, with fascicles of soft, unequal, up to 2 cm. long spinules; the other primary spathes smooth, primary branches 7–10, spreading, the lower ones 10–20 cm. long, with 3–5 secondary branches on each side (each of the latter bearing 3–4 spikelets on each side); the upper primary branches gradually shorter, each bearing distichous spikelets the latter 1·5–2 cm. long. *Involucre* shallow cupular, orbicular, entire or almost so. Male flowers 5 mm. long; calyx slightly 3-denticulate, striate; corolla 2·5–3 times longer than the calyx.

MALAYA: *Johore*, Sungai Kayu (Furtado 32,280); Kota Tinggi (Corner 29,317); Ulu Madik (Holttum 10,636); Castlewood (Ridley 11,617); Gunong Panti (Ridley in 1892); Tanjong Kopang (Ridley 6,276 and 6,284 partim); Batu Pahat (Ridley 16,207). *Singapore*, Bukit Timah (Ridley 3,492; 6,903; 9,205; 10,408; 10,813 and 10,814); Toas (Ridley s.n.); Bukit Mandai (Ridley s.n.); Upper Mandai (Ridley s.n.).

BORNEO: *Sarawak*, Kuching (Hewitt in 1906, vern. name as *Empunot*).

DISTRIBUTION: Sumatra (Type).

Ridley 6,284 is a mixture of *D. periacanthus* and *D. longipes*. Ridley (1907) had cited it under *D. longipes* but probably because Beccari (1911) cited a duplicate of this number under *D. periacanthus*, Ridley omitted it altogether in his Flora (1925).

Daemonorops periacanthus Miq. var. **macrocarpus** Furtado **var. nov.**

a forma typica differt foliolis minus coriaceis, subtus costam secus primariam interdum magis armatis; fructibus majoribus, 22–25 mm. in diam., integumento multo carnoso praeditis.

MALAYA: *Johore*, Bukit Kuing (Corner 28,645, holotypus); Gunong Lambak in Kluang (Holttum 9,365).

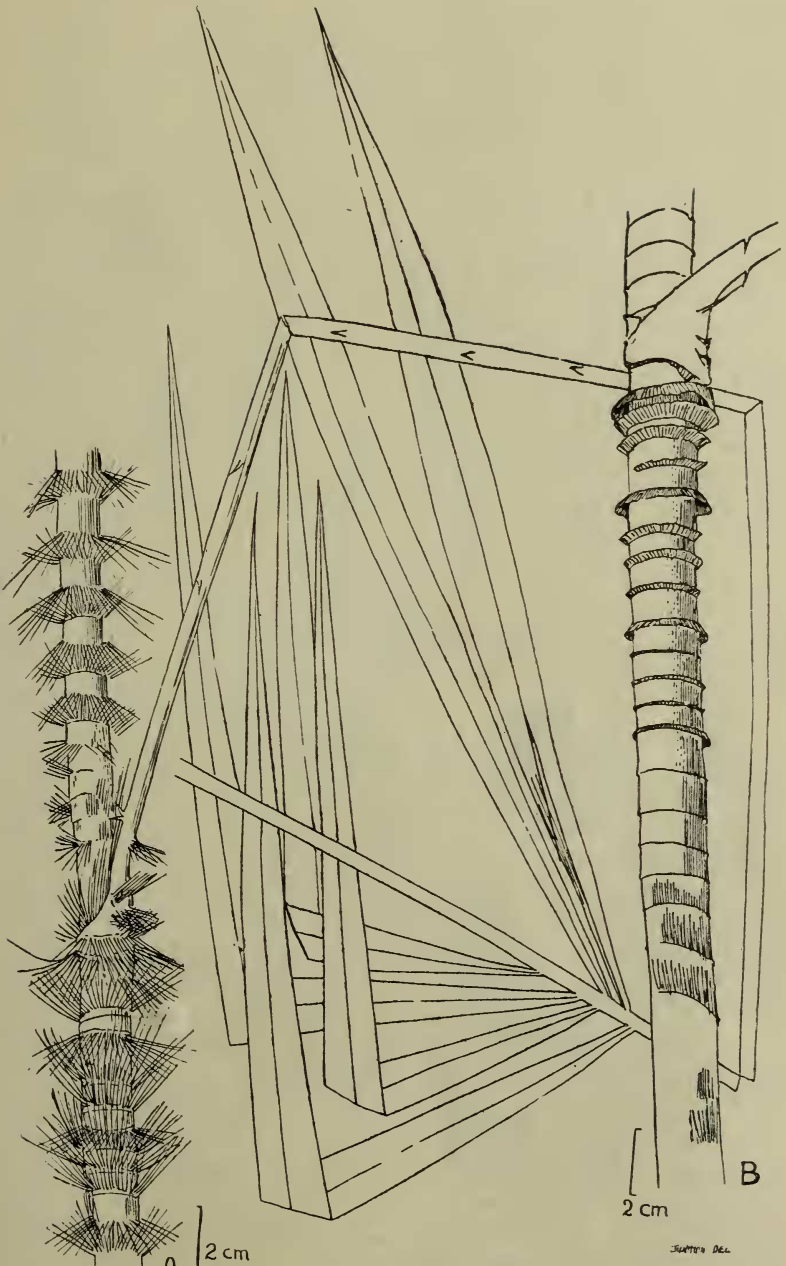
The fruits of this variety are very large and have a very thick, fleshy coat on the seed. The scales are as in the type as both to the coloration and to the number of the vertical series. The seed is slightly smaller than in the type and has a very irregular surface irregularly covered with a thick layer of dried flesh. It is not possible to say that the texture of the leaflets is a permanent feature of this variety.

Daemonorops sabut Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 469, in Rec. Bot. Surv. Ind. II (1902) 227, et in Ann. Roy. Bot. Gard. Calc. XII (1911) 181 t. 77; Ridl., Mal. Pen. V (1925) 27 p.p.; Furtado in Gard. Bull. Straits Settl. VIII (1935) 358.

D. annulatus Becc. in Rec. Bot. cit. II (1902) 226 et in Ann. cit. XII (1911) 174 t. 72; Furtado in Gard. Bull. cit. VIII (1935) 343 **syn. nov.**

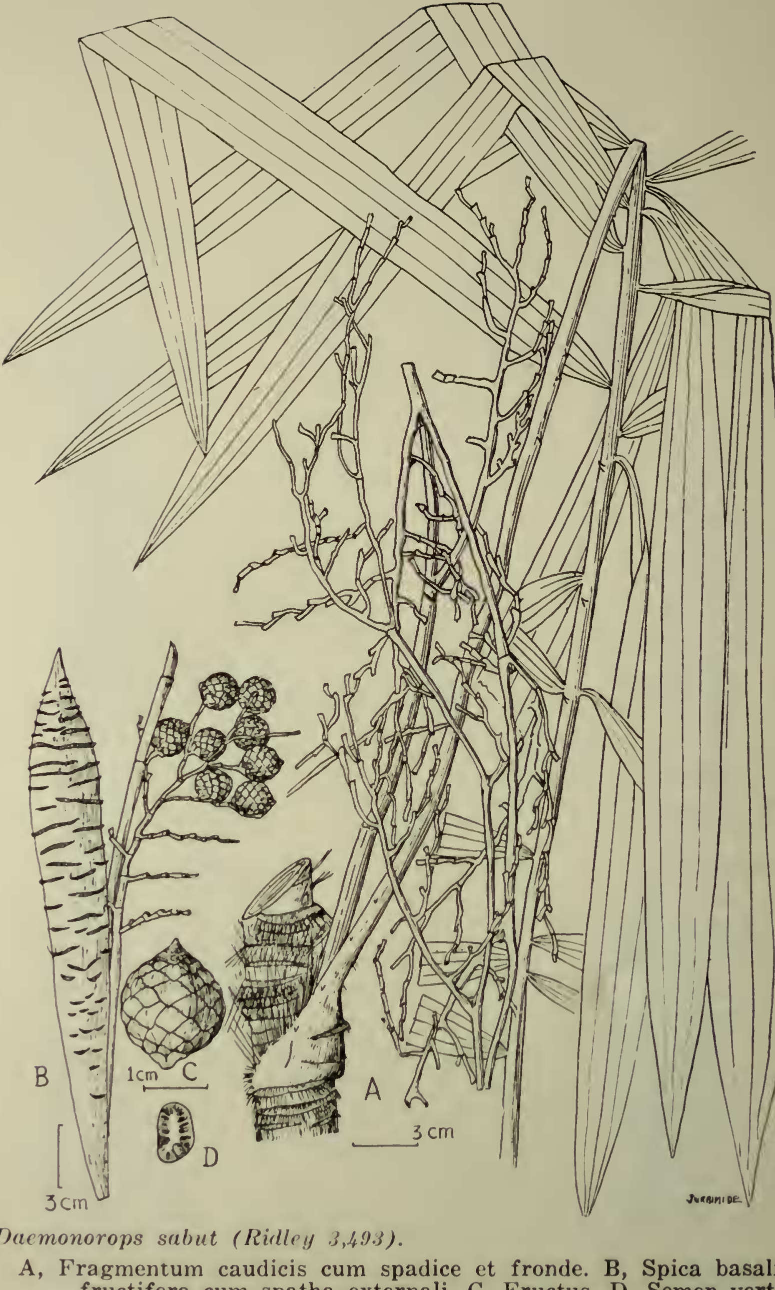
D. pseudomirabilis Becc. var. *malayanus* Furtado in Gard. Bull. cit. VIII (1935) 361 **syn. nov.**

Stem scandent, in clumps, 10 m. long, 2–3 cm. in diam, with sheaths. *Leaflets* gibbous above, densely armed with spiculae at the mouth, furnished on the body with several membranous, unequal, spiculiferous, reversed collars, nearly each one of which being opposed by another similar but smaller collar turned upwards; often interposed between these pairs is another collar having horizontal spiculae; spiculae shiny, slender, unequal, up to 7 cm. long, narrow or criniform, dark to light brown in colour, those of the opposing collars and the horizontal ones meeting and crossing to form closed galleries. *Leaves* about 2 m. long including long cirrus at the end; petiole about 50 cm. long, biconvex, slightly flattened at the base, armed at the back base with a few, short ridges bearing criniform spiculae, with reflexed short, solitary distant, black-tipped hooks along the margins and in the middle of the dorsum towards the apex; pinniferous rachis 70–90 cm. long, abruptly narrowed from the petiole at the insertion of the basal leaflets to become triangular in cross section, armed on the back at first with solitary, but higher up with 3–5-nate claws. *Leaflets* 10–20 on each side, arranged in 3–6 opposite or in upper parts also sub-opposite to alternate groups; those in the lowermost group 4–6 on each side, approximate at their base and spreading in different directions; papyraceous green, sub-concolorous; narrowly lanceolate or elliptic lanceolate, broadest about their middle, ending in a subulate, bristly tip; subtricostulate, smooth on both surfaces, or sparingly spinulous on 1–3 costae towards the apex, rarely also on the midnerve below; margins minutely spinulous; transverse veins sharp on both surfaces. *Female spadix* rather a loose, nodding panicle arising just above the axil of the leaf, about 80 cm. long; peduncle about 5 cm. long, bifacial, armed usually along the two margins with the criniform spiculae seated on short irregular crests, but sometimes also on both surfaces near the apex; on basal primary spathe seen about 22 cm. long, abruptly contracted apex, open cymbiform after anthesis, armed densely with the black criniform spiculae arranged on horizontal crests; these crests short interrupted in the basal half, longer and in some cases almost completely annular in the upper half; other primary branches 5–7 in all, alternate, distant, 15–18 cm. long (the terminal ones shorter), with angular axis bearing 4–6 bifarious, alternate spikelets on each side; secondary spathes reduced to very short, papyraceous ring having each a small triangular point on one side; spikelet axis angular, 6–8 cm. long, callused in the axil when in fruit, with 6–7 bifarous, alternate flowers on each side; spathels very shortly annular, acute triangular tip on one side. *Involucrophore* pedicelliform, 2–4 cm. long callused in the axil, angular clavate, truncate at apex slightly produced on one side; involucre slightly producing beyond the involucrophore, reduced to a very narrow annular limb round the large, circular, abruptly protruding scar of the fallen flower or fruit; areola small in the centre. *Fruiting perianth* shortly pedicelliform. *Fruit* spherical or ovate tending, when fully mature, to be oblong, conically beaked when submature, later abruptly mucronate; scales arranged mostly in 15 longitudinal series, rarely 14–17, strongly convex, channelled in the centre, yellowish brown, tinged red often in fine streaks with fine, lighter coloured, scarious margins; seed orbicular with a truncate base flattened on one side, 8–9 mm. high 10 mm. broad, 7 mm. thick, deeply ruminate, with the embryo seated at base.



Daemonorops sabut (Furtado 29,485).

A, Fragmentum caudicis juvenilis, ut spinuli appareant. B, Fragmentum caudicis spinulis caducis.



Daemonorops sabut (Ridley 3,493).

A, Fragmentum caudicis cum spadice et fronde. B, Spica basalis fructifera cum spatha externali. C, Fructus. D, Semen verticaliter discissum.

MALAYA: *Singapore,* loc. incert. (Ridley 3,515, holotype of the var. *D. pseudomirabilis* var. *malayanus,* and 3,507 as *Rotan Chochor*); Chan Chu Kang (Ridley 3,493). *Johore,* Sungai Kayu Ara (Corner and Furtado 29,485 and Furtado 29,486). Gunong Pulai (Goodall); Castlewood (Ridley in June 1909). *Perak,* Kroh (Furtado sn. on 26th May, 1937).

DISTRIBUTION: Borneo.

Goodall's specimen consists of a fruiting spadix only; its fruits are larger and oblong (17–18 mm. long, and 16 mm. in diameter), and the scales are of a more dirty brown colour, with no reddish tinge in them. With the leaves and the leaf-sheaths, I am not able to decide whether this should be separated from the type as a separate variety.

After comparing the various specimens cited above and comparing them with the descriptions and plates given by Beccari, I conclude that *D. sabut* represents a very early juvenile stage of the species of which *D. pseudomirabilis* var. *malayanus* forms the adult stage. *D. sabut* was therefore described as having terete petioles. *D. annulatus* forms an intermediate stage.

The collars on the leaf-sheaths of *D. sabut* have been described to be either reflexed or horizontal, though a few having spiculae pointing upwards may be seen even in the plate given by Beccari.

In the type of *D. annulatus* spiculae have all fallen off from the collars on the sheaths; the Sungai Kayu Ara specimens cited above, which were taken from two stems from the same clump, show two stages in the juvenile development, but agree very well with *D. annulatus.* Beccari's statement that the leaflets in *D. annulatus* are all in one plane does not apply to the leaflets in the basal group, where they spread out in different directions as shown in Beccari's plate 72. The leaflets in *Fox 14* collected on Penang Hill apparently belong to this species, though the spadix and fruits mounted with these leaflets are of *D. longipes.*

A good deal of variation may be noticed in the armature and the arrangement of the leaflets in this species; but so far no leaflets have been noticed which are spinulous on all the three principal nerves underneath. This was the reason why the Malayan specimens were separated as a variety from *D. pseudomirabilis* Becc.; but now that *D. sabut* has to be adopted for the species on the grounds of priority, the Sumatran material is named here as *D. sabut* Becc. var. *pseudomirabilis* (Becc.) Furtado **stat. nov** (= *D. pseudomirabilis* Becc.).

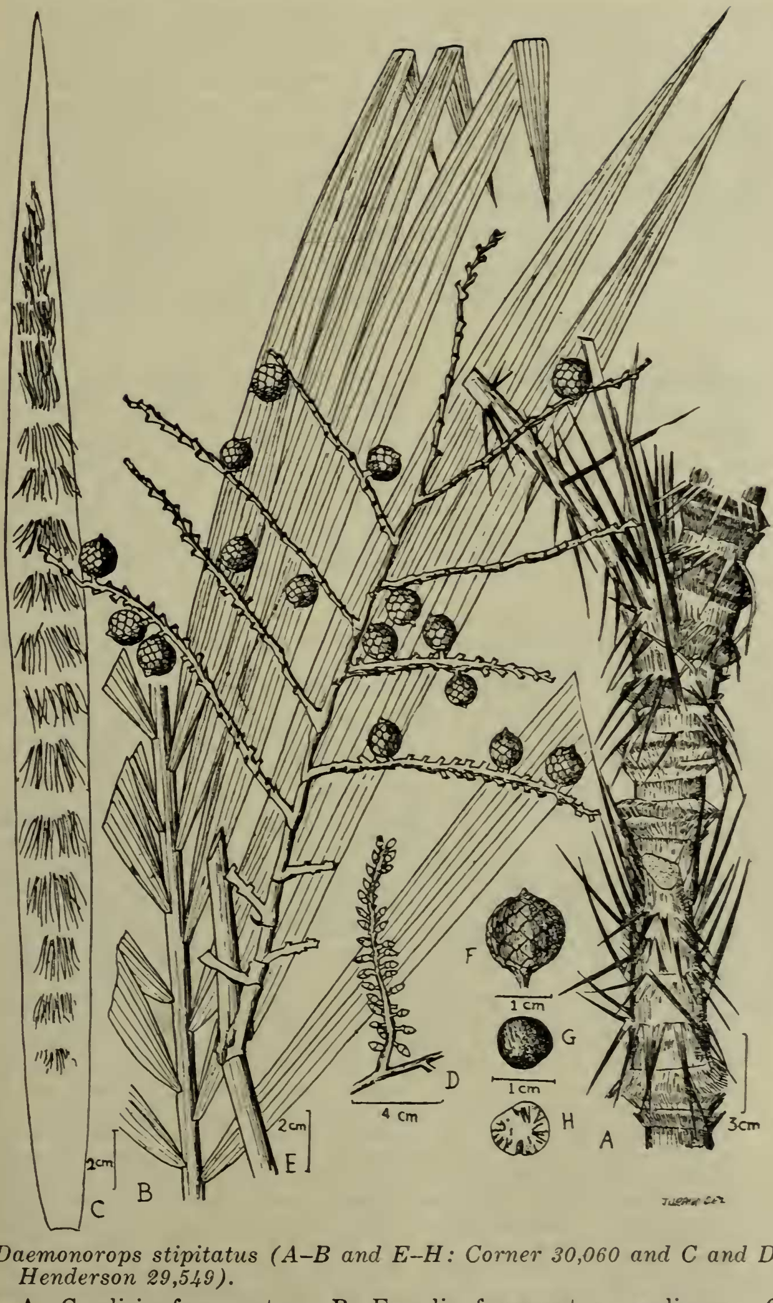
Daemonorops stipitatus Furtado **sp. nov.**

A D. verticillare cui affinissima, petiolis vaginisque frondium cum aculeis nigrescentibus armatis; foliolis secus 3–5 nervos in pagina inferiore saepe setosis; pedunculo inflorescentiae magis applanato et in marginibus magis acuto, inermi vel obscure armato; involucrophoris exsertis, conspicue pedicellatis.

Caudex scandens, solitariis, circa 12 m. longus, cum vaginis 4–6 cm. in diam. *Vaginae* frondium spinis basi in annulos membranaceos reversos unitis, 4–6 cm. longis applanatis, nigrescentibus, vel interdum stramineis, margine sinuatis vel non, inter quas spinis minoribus, criniformibus, nigris, politis, pluribus interpositis, armatae; infra annulum singulum reversum duo annuli similes sed porrecti cum spinis majoribus perpaucis vel carentibus, spiculis criniformibus pluribus siti; infra petiolum geniculatae, apice spinis ad 15 cm. usque longis nigrescentibus dense armatae. *Frondes* magnae, sine cirro 1 m. longo, 2–3 m. longae petiolus 30–45 cm. longus, biconvexus, spinis in series obliquas circum aggregatis, basi unitis, valde inaequalibus, majoribus secus margines et in dorso basali sitis, dense armatus; rachis basin versus, sicut apex petioli spinis brevibus, valde approximatis, interdum pectinatis vel in verrucas reductis, in altera parte unguibus valdis apice nigrescentibus, digitatis subtus tantum armata. *Foliola* numerosa, equidistantia infra medium latissima, apicem versus sensim angustata, penicillata, 30–45 cm. longa, 15–20 mm. lata, superne glabra vel in costa media apicem versus tantum parce setosa; inferne secus costam mediam et secus 2–4 costas subprimarias conspicue setosa, marginibus setulosa. *Spadix femineus* prope petioli basin liber, 85–150 cm. longus, in 8–10 ramos primarios spiculiferentes divisus; pedunculus 10–25 cm. longus, bifacialis, antice valde applanatus, postice convexus, inermis vel secus margines obscure armatus; spatha basalis vetusta, delapsa, tantum visa, circa 45 cm. longa, spiculis criniformibus, in series horizontalibus aggregatis, basi unitis, discoloratis, praedita; alterae spathae primariae non visae; rami primarii 10–30 cm. longi, 3–6 spiculis, alternatis, bifariis utrinsecus, praediti; spathae secundariae basi tubulosae, in apicem triangularem exeuntes; spiculae 8–12 cm. longae, primum porrectae, dein in fructu fere patentes; spathellae deciduo-furfuraceae, infundibuliformes, apice in ligulam triangularem productae. *Involucrophorum* in spathella non immersum, conspicue pedicellatum, porrectum vel horizontale, claviforme, apice obconicum, oblique truncatum; involucrum in uno latere valde exsertum, in altero latere immersum, apice cupulare, truncatum; areola concavo sublunata. *Perianthium fructiferum* explanatum. *Fructus* globosus, circa 12 mm. in diam., apice umbonatus; squamis per series 15 verticales dispositis, roseo-bruneo marmoratis, secus margines albido erosis. *Semen* fere globosum, in latere raphali minus convexum, 9–10 mm. in diam., profunde ruminatum; embryo basalis. *Spadix masculus* ignotus.

MALAYA: *Kemaman*, Ulu Bendong, alt. 150 m. (Corner 30,060, holotypus); Bukit Kajang (Corner 30,465). *Kelantan*, Sungai Chalil (Henderson 29,519).

This species is a very close ally of *D. verticillaris* from which it is readily distinguished by its pedicelliform involucrophores, usually blackish thorns on the leaf-sheaths and



Daemonorops stipitatus (A–B and E–H: Corner 30,060 and C and D: Henderson 29,549).

A, Caudicis fragmentum. B, Frondis fragmentum medianum. C, Spatha externalis. D, Spicula florifera. E, Spica fructifera. F, Fructus. G, Semen. H, Semen verticaliter discissum.

petiole bases and the 3–5 nerves being usually setose in the lower surface of the leaves. In *Corner 30,060* there is an abnormal female spadix which is reduced very much and its basal primary spathes are still on the axis though the spadix bears young fruits; all these spathes are moreover unarmed. The scales of very young fruits are nearly straw-coloured with broad dark-yellowish-brown intramarginal lines and whitish, erose margins. The scales of the fully mature fruits appear reddish-brown, but under a lens, colours of rose and brown seem to be splashed, sometimes brown in prominence, sometimes the other.

Daemonorops verticillaris (Griff.) Mart., Hist. Nat. Palm. III, 2nd. ed. III (1850) 206 and 329 pl. 175 f. III, pl. ZXII f. i & pl. ZXXII f. vi & vii; Becc. in Hook. f., Fl. Brit. Ind. VI (1893) 470; Ridl., Mat. Fl. Mal. Pen. II (1907) 186 p.p.; Becc. in Ann. Roy. Bot. Gard. Calc. XII (1911) 166 tt. 68 & 69; Ridl., Fl. Mal. Pen. V (1925) 45 p.p.; Furtado in Gard. Bull. Straits Settl. VIII (1935) 363.

D. periacanthus sensu Ridl., Mat. cit. II (1907) 183 p.p.

D. setigerus Ridl., Fl. cit. V (1925) 45 p.p.

Calamus verticillaris Griff. in Calc. Journ. Nat. Hist. V (1845) 63 et Palms Brit. Ind. (1850) 73 pl. 200 A, B & C.

Stem scandent, solitary (?), 10–15 m. long, 3–5 cm. in diam. *Leaf-sheaths* armed with usually complete spiniferous, horizontal, reflexed or porrect collars formed by the united bases of large, 4–6 cm. long or shorter, flat, light-coloured sinuous or not, black-tipped spines intermingled between the spaces with minute, black, rigid, glossy, criniform spiculae; these collars arranged in pairs, upper one deflexed downward and the lower pointing upwards to form an annular hollow and harbouring gallery; the lower collar often shorter than the upper one; between these there occurs another collar with patent or slightly porrect spines; the mouth of the sheath obliquely truncate, armed with several, very long, up to 10 cm. long or slightly longer erect, flat light-coloured, black-tipped spines; ocrea indistinct. *Leaves* large, 1·50–2·50 m. long excluding about 1 m. long, strongly clawed, cirrus; petiole 25–60 cm. long, nearly biconvex, armed densely all round, at short intervals with more or less complete rings of spines; these usually larger in the margins and in the lower surface towards the base, sometimes minute, pectinate in the upper surface; rachis in its basal portion armed on both surfaces with more or less interrupted series of small, pectinate, sometimes tuberculiform prickles, but in higher portions armed only in the lower surface with strong, black-tipped digitate claws. *Leaflets* numerous, equidistant, 3–4 cm. apart subconcolorous, narrowly lanceolate, broadest a little below the middle, gradually narrowed into an acuminate, subulate bristly tip, the largest 30–45 cm. long, 12–23 mm. broad; subtricostate; the midcosta above sharp, sparsely bristly or glabrous like the two sub-primary nerves; beneath the midcosta closely bristly and sometimes one or two nerves sparingly bristly; margins minutely setose. *Female spadix* cylindraceous at first, later when opened simple-decompound, 1–2 m. long, forming a large panicle, with 8–12 branches; peduncle 6–25 cm. long, plano-convex, sparingly prickly along the edges; primary spathes thinly coriaceous, easily detached; the outermost largest 40–50 cm. long, 3–4 cm. broad, dorsally keeled, armed externally with innumerable needle-like brittle, criniform shining-black bristles seated on short, transverse crests; in the subsequent spathes only parts exposed before the opening armed with similar but less spines or spiny crests; primary branches spreading in fruit due to the formation of the axillary callus, 20–30 cm. long; secondary spathes bracteiform, with a short tubular base and an extended, triangular acuminate apex; spikelets patent, bifarious, 5–8 on each side, 8–12 cm. long; spathels funnel-shaped, striate, produced on one side into a membraneous, reddish acuminate limb, rusty-furfuraceous on their lower part. *Involucrophore* cupular, almost reaching the apex of the spathel, obliquely truncate; involucre cupular; areola roundish with sharply raised borders. *Female* flowers ovoid, 3·5–4 mm. long. *Fruiting perianth* cyathiform at base when young, later almost entirely explanate. *Fruit* spherical, 10–12 mm. in diam.; scales arranged in 15 longitudinal series, grooved along the centre, reddish-brown with fine or obscure dark intramarginal line and with fine erose margins. *Seed* globular, 6–8 mm. in diam., slightly wrinkled and less rounded on the raphal side; albumen ruminate; embryo basal. *Male spadix* like female but supra-decompound, cupressiform panicle, more or less rusty furfuraceous; spikelets on the secondary branches, 2–4 cm. long, with bifarous, closely set, pectinate, 4 mm. long flowers seated each on a cupular, truncate involucre.

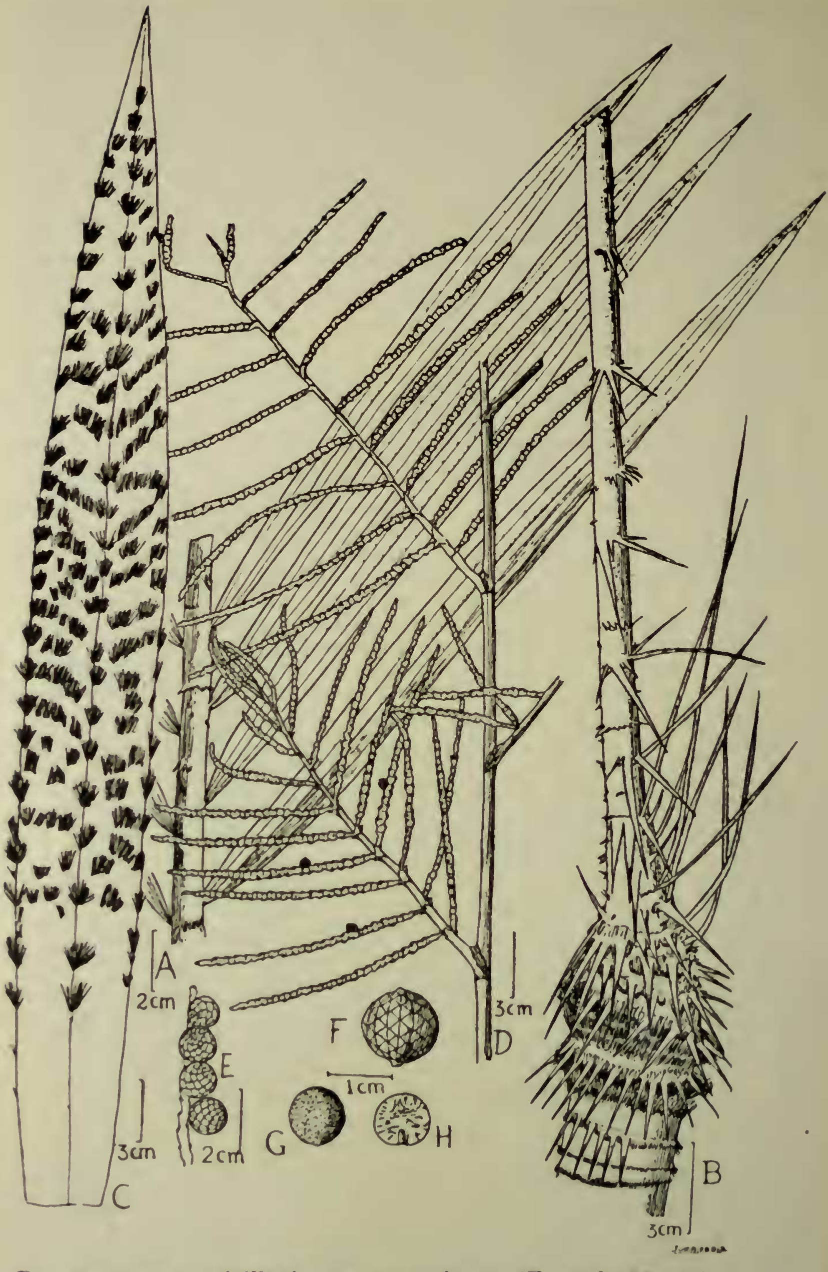
MALAYA: *Pahang,* Kuala Lipis (Machado in May 1903, and 11,632, syntype of *D. setigerus*); Bukit Chemaga (Henderson 19,478); Bukit Soga (Nur 25,162). *Selangor,* Bukit Kutu (Ridley 7,882 partim). *Negri Sembilan,* Bukit Senaling (Moorhouse as *Rotan Chin-Chin*); Senaling Inas (Holttum 9,777 as *Rotan Chin-Chin*). *Malacca,* Ayer Panas (Ridley 1,580 as *Rotan Chuchor*); Bukit Sidenan (Goodenough 1,420 as *Rotan Chuchu;* Bebas as *Rotan Kamanting,* 103 as *Rotan Duhan,* and 107 as *Rotan Dureh;* Holttum 9,664 as *Rotan Ayer*); Selandan (Ridley 10,795; Alvins 252 as *Rotan Chin-Chin*). *Johore,* Panchur (Ridley 10,953); Kuala Tebing Tinggi (Ridley 11,202 partim); Gunong Muntahak (Nur 19,983 as *Rotan Chuchor*); Mawai (Corner 29,748); Sungai Kayu (Kiah 32,174); Gunong Belumut (Holttum 10,794); Sungai Kayu Ara (Corner and Furtado 29,484); Gunong Panti (Holttum 37,394); Castlewood (Ridley 11,615).

LOWER SIAM: *Kopah,* Bukit Tinggi (Haniff and Nur 2,734).

SUMATRA: Siak (Ridley 9,093).

ANAMBA ISLANDS: Siantan (Henderson 20,178).

There are two kinds of fruits noticed in the specimens, one having reddish-brown scales as described by Griffith in the type taxon, and the other with straw-coloured scales with dark intramarginal lines. These do not represent two stages of the fruit development and so the var. *stramineus* is established for the taxon having straw-coloured scales on its fruits.



Daemonorops verticillaris var. *stramineus* (*Furtado 33,126*).

A, Fragmentum frondis. B, Petioli fragmentum cum vagina. C, Spatha externalis. D, Fragmentum spadicis. E, Spicula. F, Fructus. G, Semen. H, Semen verticaliter discissum.

Daemonorops verticillaris var. **stramineus** Furtado var. **nov.**

A forma typica differt squamis fructus stramineis, secus margines fusco lineatis.

MALAYA: *Pahang,* Kuala Lipis (Machado); Temerloh (Henderson 10,511). *Negri Sembilan,* Beremban (Furtado 33,126 as *Rotan Dahan,* Holotypus); Gemas (Nur 15,251).

The young fruit in type taxon has dirty yellowish scales but the marginal line is not so defined and conspicuous as in this variety. This dark marginal line disappears entirely in the older fruits of the type taxon.